THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LX.—No. 2. Whole No. 970. | NEW YORK, MONDAY, JANUARY 8, 1894. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—23½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C.O.D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
January Meeting, Society of Gas Lighting 37

EDITORIALS—
Briefly Told 37
Something about Brooklyn Gas Matters—Mr. Agulton's Paper—"How to Wire Buildings"—Notes.
Oil Gas Tar, by Durand Woodman, Ph.D..... 38
Coal Consumed in the United States..... 39
*Elliott's Smoke Annihilator at the Mint, Birmingham, England.... 40
The Metropolitan Gas Referees on the Candles to be Used in Testing the Lighting Value of London Gas..... 41
Manufacture of Pure Naphthaline..... 42
On the Heat of Combustion of Coal Gas and its Relation to Illuminating Power..... 42
*Matton's Overflow Device for Telescoping Gasholders..... 44
Practical Application of the Pyrometer..... 45
The Gas Engine as a Probable Motor in the Problem of Aerial Navigation..... 46
Fireproof Floors 47

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 47
Capt. Wilcox Appointed City Engineer, Macon, Ga.—What Mr. Summers' Employers Think of Him—The Attorney General Denies the Petition of the Peoples Company, Brooklyn—The Text of the Chelsea (Mass.) Company's Appeal for a Rehearing—Public Arc Lighting, Phila., Pa.—Mr. Sluman Succeeds Mr. David Moore at Salem, Mass.—Annual Meeting Ilion (N.Y.) Company—Annual Meeting, Metropolitan Company, Brooklyn, N.Y.—Something about the San Antonio (Texas) Company—Obituary Note, Dr. Charles M. Cresson—Mortgage Placed on the Hartford Company—Sueing the Citizens Company, Brooklyn, N. Y.—Sueing the Bay State Company—And Many Other Items.
Effect of Temperature on Iron..... 49
The Market for Gas Securities 50

[OFFICIAL NOTICE]

January Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, Dec. 29, 1893.

The next meeting of the Society of Gas Lighting will be held on Thursday, January 11th, at the works of the Nassau Gas Light Company, Brooklyn, N. Y.

FRED. S. BENSON, Secretary.

BRIEFLY TOLD.

SOMETHING ABOUT BROOKLYN GAS MATTERS.—The peculiar policies pursued in the past few years by those in charge of the gas supply of Brooklyn have often given rise to speculation as to whether the financiers who dictated the management of the Companies appreciated the fact that they were in charge of a business which is susceptible to control by the exercise of common sense. In fact, one might go further and be forgiven for believing that the people in charge were not quite up to grasping the situation. At any rate, there has been no harmony between the seven separate Companies, nor has any effort so far been made to establish sensible commercial relations between them. Almost everyone who has given even a modicum of consideration to the Brooklyn gas situation will agree that it has been woefully mismanaged, and that those who are responsible for its present standing are hardly the ones to be trusted to rehabilitate it. Broken faith and ridiculous deals mark the history of Brooklyn's gas supply since the time of the entrance there of the Fulton-Municipal Company; and it is also a sad thing to have to confess that at least six of the seven separate Companies are equally deep in the mire. Perhaps Mr. Addicks is to be the Moses who shall lead the Companies into peace and plenty, but we fear that his fame as a consolidator does not rest on grounds that are impregnable from attack. Certainly his tracks in other cities are not celebrated for their lack of winding ways, yet he has been measurably successful, and perhaps he will succeed in disentangling the Brooklyn snarl. If he does, he will be little short of a wonder, and from the present indications, as shown by the recent changes in the executive management of the Metropolitan Compony, which is now to all intents and purposes identical with that of the old Brooklyn Company, there is little doubt that the attempt is to be made. Aside from the foregoing, what we wish to refer to more particularly in current Brooklyn gas affairs, is the outcome of the action recently instituted by the proprietors of the Peoples Gas Light Company, who, some days ago, petitioned the State for the right to begin an action to have the charters of either the Williamsburgh or the Greenpoint Gas Light Companies declared forfeited. The basis for the action, as has already been pointed out in the JOURNAL, was that one of the offending Companies (the Williamsburgh, which also owns, body and soul, by purchase made some years ago, the Greenpoint Company) had laid pipes through the Peoples territory and leased the same to its other self, and the latter proposed to distribute gas in the disputed territory at the net rate of $1 per 1,000 cubic feet, or 25 cents less than the rate allowed by law. All this Machiavellian diplomacy (?) was exerted to enable the Williamsburgh Company to sell gas at two prices in the one district, which is contrary to the applying laws of the State. To the

disinterested onlooker the scheme was altogether too diaphanous, but the Machiavels of the Williamsburgh Company swelled to the point of bursting when they contemplated the breadth and depth of their cleverness. Having buried their heads in the sands of their cleverness they, in accordance with the practice of the desert bird whom they imitated so well, appeared oblivious to the fact that a right large portion of their "physical remainders" was exposed to the buffetings of the hunter. A head covered with sand is not so disposed as to enable the owner to breathe with either freedom or comfort, and this the Williamsburgh imitators of the ostrich retained strength enough to soon discover. In any event the application to the State by the Peoples Company had hardly been made when the Williamsburgh and Greenpoint combination, according to the press despatches, "having reached an amicable agreement in the controversy between them, the Attorney General today [December 30th] made public the decision denying the application of the Peoples Company to begin actions for the dissolution of the other two corporations. The Greenpoint Company has withdrawn from business outside of the 17th Ward and avers that it has no intention to manufacture or sell gas outside of the 17th Ward of the city of Brooklyn, or to do any act or thing whatever in the district or in any portion of the district occupied or supplied by the Peoples Company." So it seems that the Williamsburgh diplomats have had their trouble for their pains, and have again succeeded in making themselves a prominent and undisguised laughingstock for the balance of their Brooklyn brethren. It is useless to hope that they will benefit by this rebuff, for they are not of the kind who improve because of extended and changing experiences. Meantime it is worth while wishing that the situation will soon be cleared of the uncertainty that surrounds it, for as it now stands it is little short of a menace to the balance of the gas interests of the State.

MR. AGUITTON'S PAPER.—Elsewhere (p. 42) we publish the text of a paper read by Mr. P. Aguitton at the last meeting of the Society of French Gas Engineers, on the subject of the heat of combustion of coal gas and its relation to illuminating power. In our issue for September 18th, 1893, we gave a lengthy abstract of the paper, but in view of the great interest that has attached to its subject matter, we determined to reproduce it in full. The author treats the topic with precision, and in fact, his treatment of it is such that we may refer our readers to it without further comment, save to remark that its truths are patent and valuable.

"HOW TO WIRE BUILDINGS."—We are in receipt from the publisher, C. C. Shelley, College Place, N. Y., of a copy of Augustus Noll's timely book on "How to Wire Buildings," that we feel sure will be most acceptable to all who have occasion to wire buildings for the supplying of the same with electric currents for lighting or power purposes. Although Mr. Noll is fully competent to go at his subject in the most abstruse way—he is a member of the American Institute of Electrical Engineers, and has had years of experience in the theory and practice of electrical science—he very wisely concluded to take it up in an eminently practical manner, and the result is a volume that teems with information for the lineman and even his helper. To use the author's words: "Every part of the subject is treated in such a manner that beginners, wiremen and others interested in the practical branches of the art of interior wiring can, with a little attention, understand readily why certain practices are preferable to others, and how a piece of work can be rendered safe and satisfactory. It is believed that practical advice from one who has himself tested by actual work and observation the value of every rule and every suggestion here offered, will be very helpful. * * * There is as far as possible all avoidance of abstruse technicalities in the descriptions, and the divisions have been made with a view to an easier comprehension of the different parts of the subject." In our belief Mr. Noll has admirably carried out his views, and has most happily joined science to ease of understanding. The book is divided into 27 chapters, and the illustrations accompanying the text serve to complete the same to a nicety. The publisher, too, has done his part well, although to our mind he would have done still better had he omitted the advertising sheets at the end of the volume.

NOTES.—Springfield, Mo., is agitating the matter of going into the electric lighting business on municipal account.——Cambridge, Mass., is also debating the same topic, although the authorities there would go further, in that their municipal plant would be equal to the supply of gas also.——Paterson, N. J., is another municipality which is considering the advisability of electric lighting on a paternal basis.——The George M. Clark Company, of Chicago, the makers of the celebrated Jewel gas stoves, have published a handsome "Souvenir of the World's Columbian Exposition." Write to them for a copy.——We are in receipt of a handsome calendar published by Messrs. Jas. R. Floyd & Sons, of this city. Like everything else this firm does, the calendar is "well done."

[Prepared for the JOURNAL.]

Oil Gas Tar.

By DURAND WOODMAN, Ph.D.

In the manufacture of water gas a thin, watery tar is produced which presents unusual difficulties in the way of utilizing it. Ordinarily the tar from coal gas works is sufficiently freed from water to permit of distillation by allowing it to remain at rest in large cisterns, when the tar and water separate so that the greater portion of the water may be run off with very little loss of tar.

This subject is touched on in the following paragraphs from "The Distillation of Coal Tar," G. Lunge, p. 89.

"It is the first condition of a quiet, regular distillation that the tar should be freed as much as possible from the ammoniacal liquor, which is always mixed with it to a certain extent, and whose presence is a disturbing element in the distillation.

"So long as water and tar oils boil at the same time, there is always a tendency of the liquid to 'bump,' or even to be jerked over explosively. This can be overcome by very cautious, slow firing, and shortening this stage of the work is very desirable, although it is hardly possible to do without it altogether. Hence previous dehydration of the tar is decidedly advisable whenever it can be done without too much trouble [and expense].

"If the tar be sufficiently fluid, mere prolonged rest will separate a large portion of the ammoniacal water from it; for as the water is only mechanically suspended in the tar, and is of less specific gravity, it will rise to the surface, whence it can be drawn or ladled off.

"In many places nothing is done for this purpose but storing the tar in several large cisterns.

"At some works a closed steam coil is laid in the cisterns, by means of which the tar can be heated at will in order to make it more fluid and to separate the water better. In summer there is no occasion for this; in winter the tar is heated from 16° to 40° C.

"According to Girard and Delaire, the dehydration is effected by heating to from 80° to 90° C. in large boilers by means of a steam coil or jacket, or by a direct fire. The volatilized oils are condensed. After 20 to 30 hours the separation of tar and water is sufficiently complete so that the water collecting at the *bottom* of the boiler can be drawn off.

"In German works the tar is pumped into very large stills until it begins to run out at a stopcock near the top. Firing is then commenced. Before the boiling point is reached most of the water has risen to the top and can be removed."

It will be observed that according to Girard and Delaire, as quoted above, the water collects at the bottom. This will be the case when special conditions favor the presence in the tar of paraffine and light oils.

In the case of oil gas tar, sufficient fluidity exists to satisfy the most exacting; but, unfortunately, it is not accompanied by any marked tendency to separate by rest. Only a small amount of water can be removed in that way.

The application of heat not only fails to improve matters, but seems to perfect the already existing emulsion; and standing for weeks causes no appreciable separation of the water.

The tar experimented on contained:

Water	50.0 per cent.
Oils, naphthaline, etc.	20.0 "
Lampblack	4.5 "
"Pitch," just plastic, at ordinary temperature	25.5 "
	100.00
Specific gravity	1.030 to 1.040

Subjected to distillation, a small quantity of light oils passes over between 200° and 212° F. At 212° to 214° F. a strong tendency to "bump" and foam develops, and, even with great care in managing the heat, it is next to impossible to prevent the entire contents of the still from passing over with more or less violence.

The particles of water, covered by a film of oily tar, become superheated. As soon as the upper layers begin to boil and foam up the pressure is relieved on the next lower layer, and the water is converted suddenly into steam. In a few minutes the still is almost as empty as if it had been turned bottom up.

By using great caution in applying heat, distillation may be successfully carried out, but so much time is required that the operation becomes both too troublesome and too expensive.

This thin tar, containing 50 per cent. of water, not only refuses to

part with an appreciable quantity of water when left at rest, but it will take up 50 per cent. more water and hold on to it with the same tenacity.

A series of experiments was undertaken with a view to causing the water to separate by addition of some inexpensive substance which would operate in some one of the following ways:

(a) By increasing the specific gravity of the water. (Addition of a substance soluble in water but not soluble in the tar.)

(b) By decreasing the specific gravity of the tar. (Addition of a light oil.)

(c) By adding a solvent for the tar, which would tend to break up the emulsion by uniting the particles of the tar.

(d) By addition of a saponifiable oil, which when saponified after thorough mixture would carry the water with it.

(e) By adding sufficient acid or alkali to render the mixture distinctly acid or alkaline.

(f) By chilling the tar, either alone or in conjunction with other treatment.

In carrying out this line of experiment some things were tried only with a view to study the behavior of the tar when treated with different reagents, the question of commercial practicability being reserved for secondary consideration.

A laboratory experiment which is successful may become the basis of a successful commercial operation, but if everything is thrown out without trial because of apparent commercial impracticability, the most valuable clues may be entirely missed. And it may also be added that experiments which do not lead to an immediately successful result are not by any means valueless, since they play a very important part in excluding what may not be useful, to say nothing of the unexpected hints so often supplied in entirely different and perhaps more valuable directions.

(a) *To Dehydrate, by Increasing the Specific Gravity of the Water.*—100 parts tar agitated with 15 parts common salt; no separation cold. Heated to 212° F.; no separation in 24 hours. In 72 hours only 7 parts (salt) water separated.

Different proportions of salt added dry and as strong brine were equally ineffectual. In one case 40 parts water were added after 15 parts salt had produced no effect. In 48 hours 15 parts water separated.

Caustic Potash.—Agitation with solid caustic potash, about 20 parts to 100 of tar, caused a separation in 24 hours of 40 parts water.

Calcium Chloride.—100 parts tar with 5 parts concentrated solution calcium chloride caused no separation.

(b) *By Decreasing Specific Gravity of the Tar.*—Benzine, gasoline, refined petroleum, crude petroleum, ether and alcohol, were found to have little effect unless to make the matter worse, for instead of uniting with or dissolving in the tar and carrying it to the surface, they seemed to prevent what little tendency to separation there was in the untreated tar.

(c) *By a Solvent for the Tar.*—The most appropriate solvent would appear to be some of the oils obtained from the tar by distillation, but they were found to be useless. Other solvents are already included in the experiments in (b).

(d) *By Addition of a Saponifiable Oil.*—

100 parts tar—previously treated with salt.
10 " cotton seed oil.
5 " solution caustic potash (1 part to 2 of water).
50 parts water separated.

100 parts original tar.
10 " cotton seed oil.
5 " solution potash.
47 parts of water separated.

100 parts tar.
2 " cotton seed oil.
5 " saturated solution sodium carbonate.
No separation.

100 parts tar.
5 " cotton seed oil.
½ " potash solution.
30 parts water separated.

100 parts tar.
10 " linseed oil.
5 " potash solution.
2 parts water separated.

(e) *By Addition of Acid or Alkali*—

100 parts tar.
5 " potash solution.
20 parts water separated.

100 parts tar.
5 " saturated solution sodium carbonate.
No separation.

The addition of acids in any proportion had not the slightest effect.

(f) *By Chilling the Tar.*—Chilling was found to be of little value except in conjunction with the saponification (potash) treatment, which furthermore was found unavailing at temperatures above 60° F.

These experiments indicate a very close union of the tar and water, particularly those where light hydrocarbons were added—gasoline, benzine, etc.—which might be reasonably expected to cause a separation into layers.

Some temperature observations on the oil in the still and the outgoing vapors indicated that the tar reached a temperature from 20° to 30° F. above the boiling point of water before foaming took place, with the usual result of emptying the still.

This also points to a remarkable degree of adhesion between the tar and water.

A very simple method for effecting the distillation of the tar has been devised, depending more on mechanical arrangement of the still than on chemical treatment. A description of this must be reserved for a future communication.

Coal Consumed in Cities of the United States.

The following compilations from a report respecting mineral industries in the United States shows some interesting comparative figures and the importance of the fuel question. The loss in wasteful handling and generally acknowledged imperfect combustion that represents millions of dollars, leave a profitable field for invention, ingenuity and capital combined, to improve upon, if it is considered that only a fractional percentage of gain would figure up to enormous amounts. New York city received for consumption and shipment in the year of 1889, 10,253,706 tons anthracite and 4,353,436 tons of bituminous coal. Philadelphia, 4,751,175 tons anthracite and 2,620,562 tons bituminous. Boston, 1,660,001 tons anthracite and 984,409 tons bituminous coal. Buffalo, 2,480,035 tons anthracite and 1,126,765 tons bituminous coal. Chicago, 1,698,955 tons anthracite and 3,616,876 tons bituminous. The above figures include all coal used by railroad companies and delivered to steam vessels at the points named for their own fuel.

The actual quantities consumed in the various cities, excluding shipments, are as follows:

New York city, 3,300,000 tons anthracite and 1,853,436 bituminous short tons; Chicago, 1,444,250 tons anthracite and 3,221,008 tons bituminous; Philadelphia, 3,188,094 tons anthracite and 919,187 tons bituminous; Brooklyn, 1,800,000 tons anthracite and 200,000 tons bituminous; St. Louis, 85,658 tons anthracite and 2,125,391 tons bituminous; Boston, 1,242,001 tons anthracite and 524,409 tons bituminous; Baltimore, 414,928 tons anthracite and 693,685 tons bituminous; San Francisco, 29,800 tons anthracite and 375,012 tons bituminous; Cincinnati, 30,904 tons anthracite and 1,030,948 tons bituminous; Cleveland, 117,157 tons anthracite and 924,602 tons bituminous; Buffalo, 333,653 tons anthracite and 1,032,791 tons bituminous; New Orleans, 12,107 tons anthracite and 435,299 tons bituminous; Pittsburg, 2,294 tons anthracite and 334,035 tons bituminous; Washington, 481,088 tons anthracite and 45,050 tons bituminous; Milwaukee, 402,774 tons anthracite and 262,089 tons bituminous; Scranton, 422,160 tons anthracite and 9,985 tons bituminous; Allegheny City, 1,591 tons anthracite and 100,674 tons bituminous; Reading, 331,944 tons anthracite and 59,902 tons bituminous; Syracuse, 179,891 tons anthracite and 84,327 tons bituminous; Rochester, 280,229 tons anthracite and 119,667 tons bituminous; Jersey City, 334,328 tons anthracite and 132,602 tons bituminous; Newark, 410,918 tons anthracite and 133,158 tons bituminous; St. Paul, 83,675 tons anthracite and 171,367 tons bituminous; Providence, 349,641 tons anthracite and 155,985 tons bituminous; Atlanta, 1,269 tons anthracite and 208,554 tons bituminous; Denver, 10,118 tons anthracite and 300,841 tons bituminous; Paterson, 202,290 tons anthracite and 24,259 tons bituminous; Nashville, 231,300 tons bituminous; Wilmington, 158,614 tons anthracite and 128,515 tons bituminous; Memphis, 45 tons anthracite and 172,669 tons bituminous; Dayton, 4,802 tons anthracite and 178,314 tons bituminous; Louisville, 1,981 tons anthracite and 380,326 tons bituminous; Kansas City, 59,353 tons anthracite and 306,607 tons bituminous; Omaha, 41,279 tons anthracite and 244,357 tons bituminous; Indianapolis, 11,390 tons anthracite and 277,278 tons bituminous; Trenton, 148,554 tons anthracite and 132,840 tons bituminous; Toledo, 93,583 tons anthracite and 153,968 tons bituminous; New Haven, 98,943 tons anthracite and 170,359 tons bituminous.

Elliott's Smoke Annihilator at the Mint, Birmingham, England.

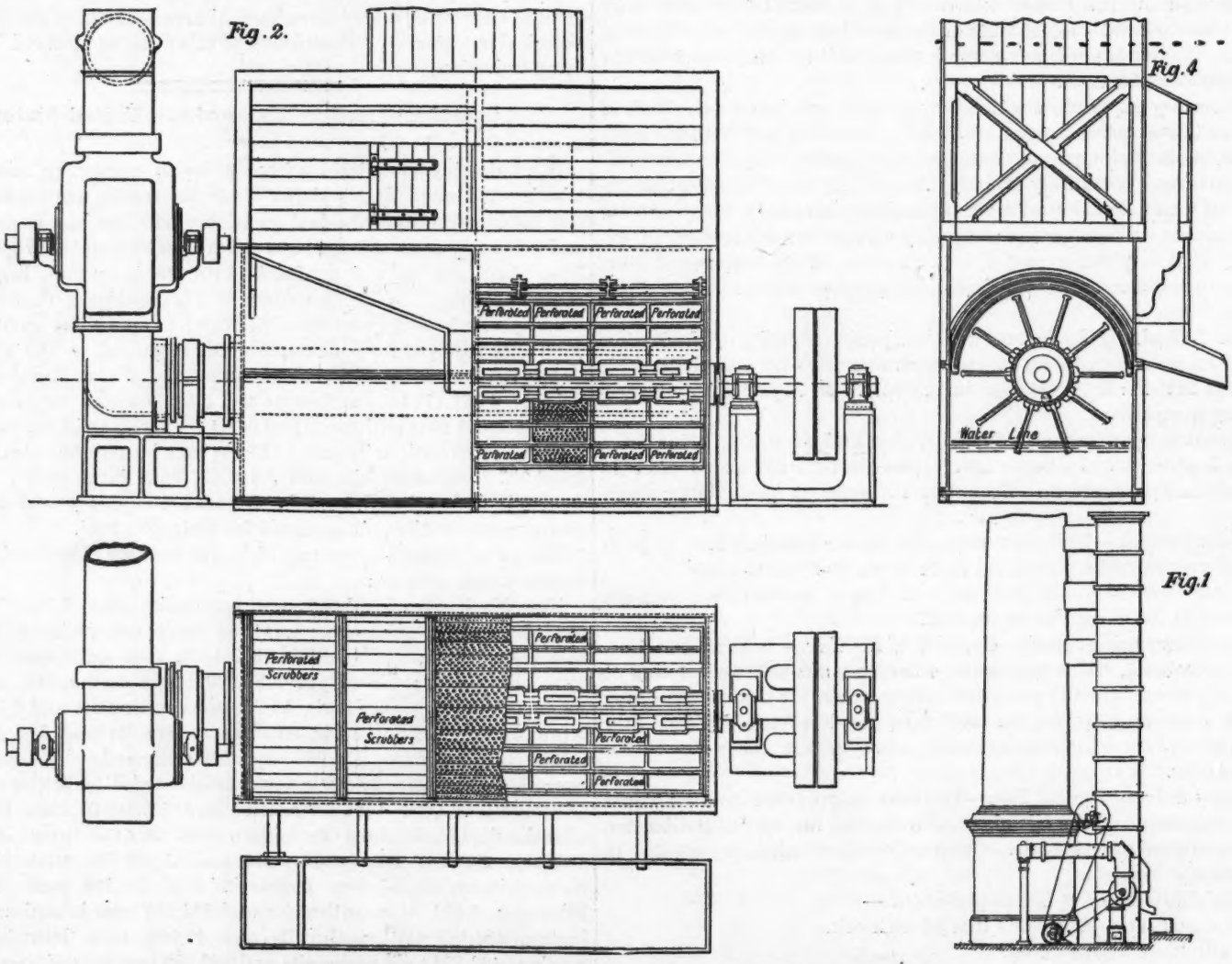
Our contemporary, *Engineering*, thus illustrates and describes Elliott's smoke and fumes annihilator, which has been at work at the Birmingham Mint for several months, and to inspect which a number of engineers from London and the provinces visited Birmingham some weeks ago. The principle of the invention, which was experimentally tried in London two years ago, is to wash the smoke thoroughly and to utilize the carbon precipitated in the water as well as the fluid drained off.

Figure 1 shows the general arrangement of the installation. The stack, which is 100 feet high from the ground level and 6 feet 6 inches in diameter, takes the smoke from three Lancashire boilers, one 30 feet by 8 feet, and two 28 feet by 7 feet 6 inches, each with two flues, and a three flue boiler 22 feet by 6 feet. In addition there is discharged into the stack the smoke from six large mufflers for hot rolling and annealing.

Formerly the Birmingham Mint was occasionally fined for allowing dense smoke to be emitted from the stack, and this, in large measure, induced the directorate to try Elliott's invention after seeing it at work at his establishment at Newbury, Berks. The fumes, instead of being allowed to pass up the chimney, are drawn off by fans at a height of about 12 feet from the ground. Fitted into the shaft or stack is a cone with the large end downwards, reducing the diameter at top to 3 feet 6 inches. An 18-inch pipe pierces the shaft, but it is proposed to substitute a 30-inch pipe, for reasons which we shall indicate later. This pipe, shown in Fig. 1, is connected to the induction opening of a fan, the casing of which is shown on the front elevation and half longitudinal section (Fig. 2), as well as on the plan (Fig. 3). This is a 4 vane fan with ordinary flat surfaces, and has been found to work more satisfactorily than many other arrangements. The diameter is 3 feet 6 inches, and it is driven by belting as shown; it runs at a speed of about 1,600 revolutions per minute.

As the function of this fan is to arrest the progress of the smoke up the chimney and drive it into the washing chamber, or annihilator, as it is called, it is necessary that it should work efficiently; otherwise smoke will find its way up the chimney, and, although the stack might under certain conditions be dispensed with, there would still be necessary a sufficient induction draft to insure combustion in the boiler. It is desirable that the air pressure given by the fan should be 10 inches according to the water gauge, but at the speed given it is from 8 inches to 9 inches. It is proposed, however, instead of driving the fan from a separate engine, to convey the motive power from the hot rolling mill engines through a shaft underground for 50 feet. This shaft will run at 100 revolutions per minute. It is hoped by this means to increase the speed of the fan, which, combined with a larger pipe already referred to, will give greater efficiency. The fan, it may be stated, is cleansed from sooty deposits by jets of water which play upon it and the bearings.

The smoke is forced through a pipe into a revolving barrel fitted with long blades as shown in the end section (Fig. 4). This revolving barrel, which is of cast iron, is about 11 ft. long and 16 in. in diameter. It is perforated with holes from ¼ in. to ⅜ in. in diameter, and fixed to it, as shown, is a series of beaters like the blades of an old-time paddle steamer.



Elliott's Smoke Annihilator at the Mint, Birmingham, England.

These blades also are perforated, as indicated in Figs. 2 and 3. In the cast iron casing in which this revolving barrel works, there is a quantity of water, as shown on Fig. 4, constantly replenished by a small jet entering from the top. The smoke passes through the pipe into the interior of the revolving barrel, and thence through the holes.

The result of the beating of the water is to insure the precipitation of all the carbon and sulphur in the smoke or fumes. The barrel, driven by belt gearing, makes from 180 to 200 revolutions per minute. Over the chamber are semicircular coverings or gratings, shown in section in Figs. 2 and 4, and on plan in Fig. 3. These are simply to prevent the water or carbon finding its way to the upper part of the shaft. The hot vapor given off readily passes through the perforations and up the timber trunk shown on Fig. 1, and finds its way into the chimney or stack about 50 ft. or 60 ft. above ground level.

Opportunity was afforded of ascertaining the effect of the working of this apparatus some weeks ago. The stack was giving forth smoke when the mechanism was started, and in five minutes there was a very perceptible change, while in eight minutes only a greyish white vapor was emitted, and this was easily dissipated. Dr. Heaton, of Charing Cross

Hospital, made analysis of the discharged gases, and stated in his report that there was not detected any trace of sulphurous or sulphuric acid, while carbon was also entirely absent.

The residual products collected in the annihilator are utilized for various purposes. The scum passes out from the chamber as shown on Figs. 1 and 2, and into a wooden box shown on Fig. 3. Here it appears as a black and opaque bubbling liquid, the analysis of which by Dr. Heaton is given as follows:

"The liquid was slightly acid. Qualitative analysis showed the presence of copper, iron, sulphates and chlorides, and the absence of zinc and sulphurous acid.

"The liquor contained, in 100 grain measures:

	Grains.
Combined water and volatile matter	.646
Ash	.558
	1.204

"Complete analysis gives the following results:

	Parts Per Cent.
Sulphate of iron (green vitriol)	.40
" copper (blue vitriol)	.30
" ammonia	.08
Sulphuric acid (free)	.005
Insoluble organic matter	.022
Volatile organic matter	trace

"It is evident that the important constituents here are the sulphates of iron and copper. The following experiments were made to determine whether any appreciable quantity of tar compounds was present: 1. A portion of the liquid was shaken with ether and a little acid. The ether, when decanted and evaporated gently, yielded a residue too small to be weighed, and which, when tested, was found to contain no trace of carbolic acid. 2. Two other portions of the liquid were treated respectively with acid and with alkali. Each was distilled separately, and the distilled portions extracted with ether as before. Practically no residue was contained in either case, but the distillate from alkali after ethereal treatment developed on the watch glass a slight smell like creolin."

The liquid is drained off through a sieve, and is said to have valuable properties as a disinfectant, for which it is already sold commercially, while the carbon is used for many purposes after it is dried, notably for arc lamps. The plant at the Mint is worked by a 40-horse power engine and portable boiler, which is fitted with a similar arrangement for smoke prevention, but here the vapor passes off from the annihilator into the air.

The Metropolitan Gas Referees on the Candles to be Used in Testing the Lighting Value of London Gas.

The Metropolitan Gas Referees have issued the following notification respecting the candles to be employed in testing the lighting value of the gas supplied by the companies over which they have jurisdiction:

The candles to be used for testing the illuminating power of gas are defined by the Metropolitan Gas Acts as "sperm candles of 6 to the pound, each burning 120 grains an hour." But whereas candles coming within this definition, but differing in other particulars, differ greatly in the light they give; and whereas a controversy has arisen between the London County Council and the Gas Companies as to the candles which should be used in testing; and whereas the Chief Gas Examiner has disallowed a return of the illuminating power of gas on the ground that "candles of different manufacture, possibly of different illuminating power from those usually employed in the testing-places, and which had not been prescribed nor certified by the Gas Referees, were employed in the tests against which the Company have appealed;" and whereas the London County Council have called upon the Gas Referees to prescribe and certify the candles to be used in the testing-places; and whereas it is the duty of the Gas Referees (Gaslight and Coke Company Act, 1876, Sec. 34) from time to time to prescribe and certify the apparatus and materials in the testing-places for testing the illuminating power of gas, and of the Company to provide such apparatus and materials accordingly; and whereas sperm candles are the material by which the illuminating power of gas is tested; we do therefore hereby prescribe as follows:

(1) All candles to be used in the testing-places shall be made with the materials hereinafter prescribed, and shall, when made, be examined and certified by the Gas Referees.

(2) The wicks shall be made of three strands of cotton plaited together, each strand consisting of 18 threads. The strands shall be plaited with such closeness that, when the wick is laid upon a rule, and extended by a pull just sufficient to straighten it, the number of plaits in 4 inches shall not exceed 34, nor fall short of 32. Each wick shall be of suitable length, and looped ready for fixing in the mould. After having been bleached in the usual manner and thoroughly washed (see Appendix), the wicks shall be steeped in a liquid made by dissolving one ounce of crystallized boracic acid in a gallon of distilled water, and adding two ounces of liquid ammonia. They are then to be gently wrung or pressed till most of the liquid has been removed, and dried at a moderate heat. Twelve inches of a wick thus made and treated shall not weigh more than 6.5, nor less than 6 grains. The weight of the ash remaining after the burning of ten wicks which have not been steeped in boracic acid, or from which the boracic acid has been washed out, shall not be more than 0.025 grain. Wicks made in accordance with this prescription shall be sent to the office of the Gas Referees, by whom they will be examined and certified. The wicks so certified are to be used by the candle-maker in the condition in which they are returned to him.

(3) The spermaceti of which the candles are made shall be genuine spermaceti, extracted in the United Kingdom from crude sperm oil, the product of the sperm whale (*Physeter Macrocephalus*.) It shall be so refined as to have a melting-point lying between 112° and 115° F. An account of the method by which the melting-point of the spermaceti is to be determined is given in the Appendix. Since candles made with spermaceti alone are brittle, and the cup which they form in burning has an uneven edge, it is necessary to add a small proportion of beeswax or paraffine to remedy these defects. We therefore prescribe that the best air-bleached beeswax, melting at or about 144° F., and no other material, shall be used for this purpose, and that the proportion of beeswax to spermaceti shall not be less than 3 per cent., nor more than 4½ per cent.

(4) The candles made with the materials above prescribed shall each weigh, as nearly as may be, one-sixth of a pound, and will be found to answer to the following test: Immerse a candle, taper end downwards, in water of 60° F., with a brass weight of 40 grains attached to the wick by a small piece of thread. When a further weight of 2 grains is laid on the butt end of the candle, it will still float; but with a weight of 4 grains it will sink. As the rate of burning of a candle is affected by the force with which the wick is pulled when it is set in the mould, the strain commonly applied by an experienced maker of candles has been measured, and is found to be about 24 oz. The candles shall be sent to the office of the Gas Referees, by whom samples from each batch will be examined and tested. Each batch of candles shall be accompanied by a specimen of the spermaceti (unmixed with beeswax) which was used in making them. Packets of candles approved by the Gas Referees will be sealed by them, and certified for use in the testing-places.

(5) The candles are to be used by the Gas Examiners as heretofore, in accordance with the half-yearly "Notifications" of the Gas Referees. The results are to be corrected as usual, on the assumption that for small variations the light of a candle varies directly with its consumption; and if any candle in a packet certified by the Gas Referees is found by a Gas Examiner to burn at a rate exceeding 126, or falling short of 114 grains per hour, the testings made with that candle are to be rejected.

Appendix.

Method of Determining the Melting-Point of the Spermaceti.

As various methods are used by different refiners of spermaceti for determining the melting-point, which lead to different results, it must be noted that the temperatures here given as the limits within which the melting-point of a sample of refined spermaceti should fall—viz., 112° and 115° F.—have been found by the following method, which is known as the capillary tube method:

A small portion of the spermaceti is melted by being placed in a short test-tube, the lower end of which is then plunged in hot water. A glass tube drawn out at one end into a capillary tube about 1 mm. in diameter is dipped, narrow end downwards, into the liquid spermaceti, so that, when the tube is withdrawn, 2 or 3 mm. of its length are filled with spermaceti, which immediately solidifies. The corresponding part of the exterior of the tube is also coated with spermaceti, which must be removed. The narrow part of the tube is then immersed in a large vessel of water of a temperature not exceeding 100° F. The lower end of the tube which contains the spermaceti should be 3 or four inches below the surface, and close to the bulb of a thermometer. The upper end of the tube must be above the surface; and the interior of the tube must contain no water. The water is then slowly heated; being at the same time briskly stirred, so that the temperature of the whole mass is as uniform as possible. When the plug of spermaceti in the tube melts, it will be forced up the tube by the pressure of the water. The temperature at the moment when this movement is observed is the melting-point.

Method of Washing Wicks.

As it is found to conduce to the regular burning of candles that the wicks should have been as far as possible cleaned and freed from mineral matters, it is recommended that the candle maker, before steeping the wicks, shall wash them first in distilled water made alkaline with between 1 and 2 per cent. of strong liquid ammonia, then in dilute nitric acid containing about 10 per cent. of strong acid, and then repeatedly in distilled water.

Manufacture of Pure Naphthaline.

The *Journal des Usines a Gaz*, in describing a method followed in France for the manufacture of pure naphthaline, says :

The crude naphthaline obtained in crystals with the heavy oils in the fractional distillation of cold tar, is subjected to distillation as follows:

A still 7 feet in diameter and 7 feet deep, with a concave bottom and clearing hole for emptying through a cock on the cover of the hole. On the top of the still is a cover with improved manhole, closing mechanically, insuring rapidity of opening and a tight joint. A sensitive pressure gauge and an iron pipe case for thermometer, also a safety valve adjusted to open at a slight pressure. The naphthaline vapors pass from the top of the still by a pipe, 6 inches in diameter, into a condensing coil ; this pipe has a ½-inch steam pipe passing through it ; fitted with cocks, and entering the cooling water surrounding the coil. A small thermometer, fixed in a case on the pipe, serves to check the indications of the still thermometer. To guard against risks of fire, the still is fixed in a shed outside the building where the condensation is effected, and the pipe between the still and condenser, being exposed by variable temperatures tending to solidify the naphthaline, is covered with non-conducting material. The condensed fluid runs from a still into a cylindrical receiver, fitted with a manhole and a blow-off cock, and also a steam coil for keeping the contents in a fluid state. This receiver is 7 feet diameter and 4 feet deep. In some cases horizontal receivers are used but they are less convenient.

Crude naphthaline is charged into the still through the manhole and a small fire lighted beneath the still to melt the charge. The still is filled so as to leave a space above the liquefied material, the charge consisting of over 5 tons of the crude naphthaline, a quantity of caustic soda solution of 70° Twaddle, corresponding to about 30 pounds of 70 per cent. caustic soda, is added, and the distillation is then started. Care must be taken that the safety valve is in good order, and that the thermometer cases are filled with oil to enable variations in the temperature to be quickly observed. Steam is passed through the pipe between still and condenser to prevent the naphthaline solidifying, and from this pipe into the water surrounding the condensing coil, so as to maintain a temperature of 176° F., and steam is also passed into the coil in the receiver.

The first products are chiefly water, oily matter and a little naphthaline. The latter does not begin to come to the surface in the still until 410° F. is reached, and the water and other matters disappear as the distillation proceeds. Small samples are taken from time to time from the end of the condensing coil, and, so soon as no more aqueous matters come over, the condensed products, which up to this time have been run into a separate receptacle, are then turned into the receiver and the distillation is continued until a temperature of 455° F. is reached ; the distillation is then stopped, and the fire extinguished. The naphthaline is thickened to the consistency of building mortar, by mixing it with the residues of naphthaline obtained from previous operations. This paste is then put into coarse sacks and submitted, while hot, to a pressure of 6,600 pounds per square inch. The oily matters thus pressed out are collected and sometimes used for liquid fuel, and the naphthaline remains in the form of a hard cake.

A second distilling apparatus, similar to the preceding one, and fixed near to it, is filled with the compressed material, and at the same time about 110 pounds of commercial sulphur ; heat is applied and the distillation is carried on as before. The first products are put aside and treated in the same way as the other products from previous distillations, but in this second distillation a considerable quantity of sulphureted hydrogen is developed ; this is conducted into a box fitted with trellissed iron obstacles, or some similar arrangements, to arrest any naphthaline accompanying the gas. The sulphureted hydrogen is then passed into the chimney or into an aspirator filled with oxide of iron. The naphthaline is collected in a receiver similar to the one before described, and is maintained in a fluid state until the following morning. It is then driven out by compressed air, or aspirated, into a third similar still. A quantity of soda solution of 70° Twaddle, corresponding to about 50 pounds of 70 per cent. caustic soda, is added and the naphthaline is again distilled. In this distillation the caustic soda reacts at a temperature below 320° F., and to prevent a reaction in the opposite direction at a higher temperature, the fire is withdrawn so soon as the thermometer indicates 330° to 338° F. The contents of the still are allowed to deposit for an hour when the caustic soda and other impurities are drawn off and the distillation continued as before, by putting aside the first runnings and stopping the operation at 455° F. The refined naphthaline contained in the receiver is then run off into galvanized iron moulds, each containing about 10 gallons, and left standing to solidify. They are then emptied and the naphthaline broken into pieces, a fine white commercial naphthaline being obtained, with a melting point between 174½° and 175° F., free from fatty matter, and suitable for preparing naphthalmines, oil of naphtha and dye colors.

On the Heat of Combustion of Coal Gas and Its Relation to Illuminating Power.

By Mr. P. Aguitton.

[Translated for the American Gas Light Journal from the *Journal des Usines a Gaz*, by Mr. Herman Poole.]

The more extended utilization of coal gas as a source of heat, of motor force and, quite recently, of light by incandescence, has drawn attention to a question but little appreciated until now, and on which we have but general ideas. I speak of the heat of combustion of coal gas.

If we look up some facts on this subject we will see that nearly all experimenters have been satisfied to take only a glance at any time of the day, whether in the laboratory or at the works ; hence we have found figures so different, figures without any datum, which can show us what gas has been analyzed.

Mr. Aime Witz allows, as the heat of combustion of a cubic foot of gas, under normal conditions as to temperature and pressure, 268 heat units. Mr. Mahler found 286 heat units for the heat of combustion of 1 cubic foot of normal gas at 32° F. temperature, 29.9 inches pressure, and anhydrous.

Finally, Mr. Bueb gives the amount of 262 heat units. All these results suppose the aqueous vapor condensed.

The question deserved to be examined from a more precise view, for it was tantamount to supposing that the combustion heat of gas would vary with the quality of the gas submitted to the experiment.

My researches have been carried on keeping in view the relation between the combustion heat and the illuminating power of a coal gas, which gas was made by methods actually in use.

Combustion Heat of Coal Gas and Its Relation to Illuminating Power.—The experiments may be referred to the following operations :

1. To distill a certain quantity of coal under determined conditions to obtain a gas of a given richness.

2. To determine the illuminating power of this gas, and also to determine its combustion heat.

All the distillations were made in our experimental plant at the works.

Gases with high illuminating power were given by cannel coal. They may be obtained by taking the first portions of the distillation of a good coal.

Distillation pushed to the limit or end of the charge gave, on the contrary, only poor gases.

It is well to notice that all the samples of gas were obtained in this manner of distillation of coal and were not made by mixtures of air and enrichers, or by the addition of hydrocarbons to ordinary gas. The illuminating power was obtained by means of Dumas and Regnault's photometer.

To determine the heat of combustion of the gases, I used the apparatus made by Mahler called the *Obus*. I chose this apparatus for the following reasons :

Mr. Aime Witz, for his experiments, used the calorimetric bomb which he describes in his paper on gas motors. The chamber where the explosion was made had a volume of 15.55 cubic inches ; but to have a detonating mixture he was obliged to introduce six parts of air, which reduced the volume of the gas to be analyzed to 2.2 cubic inches. This quantity of gas is small, since it is necessary for calorimetry to deduce results from very small differences of temperature.

Mr. Bueb, in line of contrary ideas, wished to operate on a large volume of gas and adopted a continuous apparatus. It is easy to see what sources of error are inherent in this method of calorimetry. Not only is it difficult to keep a current of gas and a current of water perfectly constant, but we multiply also all sources of error from loss by radiation because of the lengthening out of the time of the experiment.

The apparatus which I have used for my experiments is the bomb of

Messrs. Berthelot and Vielle, modified so very happily and rendered practical by Mr. Mahler.

The apparatus modified by this engineer is composed of the ordinary calorimeter with its envelope of felt; an agitator with a helicoidal move ment, allowing perfect mixture of the water without fatigue.

The bomb in which the explosion is produced, called the obus by Mr. Mahler, is a cylinder of iron or soft steel, coated interiorly with very thin enamel and nickeled exteriorly. The lid is screwed on with a packing of lead, and carries a cock allowing the introduction of the gases. Below, two platinum wires serve to hold a small vessel which contains the gas, if the calorific power of a coal gas is required.

The burning, whether of solid or gaseous combustible, is effected by means of the fusion of an iron wire traversed by a current from a Trouve electric pile.

The volume of the obus is 35 cubic inches. The important feature of the apparatus consists in the adoption of oxygen at a high pressure, which is now found in commerce (Continental Company for the Manu facture of Oxygen). This oxygen is furnished in cylinders of iron at a pressure of 120 atmospheres.

By this device, introducing the oxygen at 5 atmospheres pressure, we may operate on the entire volume of the obus, even up to 35 cubic inches.

The thermometers adapted to the apparatus allow reading with the naked eye to one half a degree, which corresponds for illuminating gas to about 5-millionths of error.

An experiment with gas may be made with this apparatus in 20 minutes, and offers no practical difficulty.

We have been able to put together about 100 samples of gas of different richness, without considering all those which came on a result already known.

The illuminating power is given in liters by the Dumas and Regnault photometer, and in candles, all referred to the temperature of 60° F., at 29.9 inches pressure and anhydrous. This last method of giving the illuminating power of a gas results from the decision of the International Congress of 1889. The Carcel lamp is equal to 9.6 decimal candles, French (13.4, English).

To define the illuminating power I have taken the volume of 3.5 cubic feet of gas burnt per hour instead of the unit of 5 cubic feet adopted in England. This figure of 3.5 cubic feet is more in conformity to our decimal system, and approaches closely to the ordinary consumption of our gas jets.

The heat of combustion is given for a cubic foot of gas at the temperature of 60° F. and pressure of 29.9 inches, the aqueous vapor being supposed condensed.

All the points given by the experiment have been united in a diagram, the abscissas representing the intensities in decimal candles, the ordinates the heats of combustion.

These points united give us very nearly a straight line, having for its equator $C = l \times 352.6 + 2{,}280$, in which C = the heat of combustion of one foot of gas as defined above; l = the intensity in candles.

The following are the results from this formula in a tabular form:

Intensities of 5 Feet of Gas, Bengel Tip, Candles and Tenths.	Coresponding Photometric Value Given by Dumas and Regnault Apparatus. Volumes Reduced to 60° F. and 29.9 Inches.	Heat of Combustion of One Cubic Foot of Gas at 60°F. 29.9 Inches, and Anhydrous.
21.15	23.20	386
20.45	3.31	377
19.74	3.42	368
19.03	3.55	359
18.33	3.69	350
17.62	3.84	341
16.92	4.00	332
16.33	4.15	323
15.65	4.36	314
14.87	4.55	305
14.01	4.80	296
13.39	5.00	289
12.69	5.25	280
11.98	5.33	277
11.28	5.64	269
10 57	6.40	260
9.87	6.85	251
9.17	7.38	242
8.46	8.00	233
7.75	8.72	225
7.35	9.60	216
7.00	10.50	206

From this it results that 5 cubic feet of gas at a value of 5.25 cubic feet, that is to say, normal, at 60° F., 29.9 inches pressure, and anhydrous, the aqueous vapor produced by the combustion being condensed, develops in burning at constant volume 280 heat units.

We see by the tables what variations the heat of combustion of coal gas show according to its richness in illuminating elements.

From 206 heat units developed by a gas of 7 candle intensity, we pass to 386 heat units for a gas of 21 candles, a variation of 180 heat units for a difference of 14 candles.

How great may be the error of the experimenter who would compute, taking generally, as of no difference, for any illuminating gas the number 9,900 as the heat of combustion! What proves it besides, are the numerous mistakes experienced in the purchase of gas machinery in England. We know that coal gas is composed of—

1. Inert gases, carbonic acid, nitrogen;
2. Combustible gases, non-illuminant, hydrogen, carbonic oxide, formene;
3. Combustible and illuminant gases, designated under the general name of heavy hydrocarbons.

There results from our calorimetric experiments that the relation between the respective quantities of the different combustible but not illuminant gases is fixed. In effect, if the proportion of formene, for example, should increase in a narrow limit in relation to that of hydrogen, there would result an augmentation of the heat of combustion which would be accompanied by no change in illuminating power.

This conclusion conforms with the experiments of Mr. Sainte Claire Deville, who has established that in the gas produced by the different kinds of coal, the relation between the proportions of hydrogen and formene is very slightly variable, and that, moreover, the illuminating power is above all dependent on variations in strength of the gas in illuminant hydrocarbons, incondensable at 0° F. (ethylene, propylene and acetylene).

Finally, the heat of combustion of gas is intimately connected with its illuminating power. It depends often on the proportions of illuminating hydrocarbons contained in greater or less quantity in the gas.

I believe I have shown that the illuminating power and heat of combustion are one and the same thing, and that a gas from coal of which we know exactly the heat of combustion, is also as well if not better known by it than by the illuminating power, which itself varies with every change of tip employed.

Actually, the gas delivered for consumption is employed partly for light and partly for heat; but the time will come, above all if the adoption of the Auer burners becomes general, when we may consider gas as utilized almost exclusively for its heat of combustion.

In these conditions we may ask why should we keep the photometer, whose indications are much less reliable than those of the obus, as a means of control, when we have at hand a true balance of precision, giving us at a single test, and very exactly, the value of the gas, as well from view of light as heat and motor force.

This conclusion which I deduce from my researches may appear a little bold, or at least a little premature; but, supported by more than 150 experiments, made with the most rigorous precision, thanks to the apparatus of Mr. Mahler, I do not think I mistake in predicting the supplanting of the photometer by the calorimeter in the verification of the quality of coal gas.

On the Influence of the Heat of Combustion of Coal Gas on the Intensity Given by the Auer Burner.—I come now to a question which is often presented to the minds of many and which proceeds from the experiments cited.

Does the quality of the gas influence the intensity given by the Auer burner?

A priori, we may answer, yes, since, as I have shown, it is the illuminant hydrocarbons alone which cause variation in both illuminating power and the heat of combustion of the gas.

But we must seek in what limits these variations are felt with the burner.

I have, then, made again a second series of tests with gas of different richness—we determined each time the heat of combustion of the gas employed; this same gas was then burnt in an Auer burner, whose intensities were tested by means of a Foucault photometer.

The following table shows the intensities in candles given by 5 cubic feet of gas of known heat of combustion, in an Auer burner.

We see that to each gas of different richness corresponds an intensity which increases with the number of thermal units contained in a cubic foot of gas employed.

These intensites, contrary to what we should expect, vary in a large

degree. An Auer burner supplied with gas of 24 units, giving 57.25 candles, may, with gas of 38.3 units, give 129.9 candles, almost double.

Heat of Combustion of the Gas Employed.	Intensities Given by 5 Cu. Ft. in the Auer Burner. Candles.	Number of Thermal Units for an Intensity of 10 Candles.
383	127.9	33.4
333	104.2	31.3
300	98.9	30.3
284	88.7	32.0
279	86.4	32.3
273	84.1	32.4
259	70.2	36.9
252	63.7	39.5
242	57.3	42.2
111 (hydrogen, impure)	23.0	48.3

The second diagram well shows this law. We will notice that from 250 to 30 the curve rises very rapidly. From this point the intensity remains the same for intersecting heats of combustion.

That could not evidently be predicted from the form of the burner, which is not constructed to utilize rich gases. Some modifications for a more energetic air supply and a more complete mixture of the gases would be necessary if we were forced to burn only gases of great illuminating power.

For poor gases the curve tends to approach the horizontal. We have been led to supplement the curve by following with a test made with the Auer burner supplied with impure hydrogen of 75 per cent. The heat of combustion of this hydrogen was .111, and its intensity was 23 candles for 5 feet.

All the tests have been made with an Auer burner, number 2, disposed in a way to be able to easily vary the admission of air according to the richness of the gas. On the diagram I have shown the intensities corresponding by given gas burnt in a Bengel burner.

We see immediately the great difference which exists between the two burners. Five feet of gas of 300 units will give us, with the Bengel, an intensity of 14 candles, and with an Auer an intensity of 98 candles—seven times more intense in luminosity.

If we divide the number of heat units contained in these five feet by the intensity, we obtain the yield of the burner; that is to say, the quantity of heat units to furnish to an Auer burner according to the richness of the gas to have the intensity of 10 candles.

This number is not constant, and if we compare the figures thus obtained, we see that the curve uniting these points passes a minimum.

This point will give as the minimum of heat units to furnish a burner for an intensity of 10 candles; it is 30 heat units, and corresponds to a combustion heat of about 300 units and corresponds to a gas of 4.80 *titre*.

The result was, I believe, very interesting to show, for it proves also that, at equal price, the maximum of yield of this burner is given by a medium gas.

This minimum figure of 30 calories per candle we approach very closely in the mechanical yield of the incandescent electric lamp.

One heat unit corresponds to work of 213 megergs, so that $3 \times 21.3 = 63.9$ megergs, or $63.9 \div 4.733 = 13.5$, or 13.5 Watts per candle.

The incandescent lamp giving 16 candles at 100 volts for a current of .56 amperes needs 3.5 Watts per candle.

We see how much the mechanical duty of the gas employed as source of light is modified, and how much we approach that of the electric incandescence if we recall that the duty with the Bengel burner is 99 Watts.

There remains still a point to clear up:

One of our technical journals related lately the experience of one of our ablest chemists, who pretended that the intensity of the Auer burner was independent of the richness of the gas employed. He demonstrated it by causing gas to pass over coke soaked with Colza oil.

The intensity of an Auer burner supplied by this gas and measured by a photometer was equal to that of the same burner burning gas from the works.

Now Colza oil has the property of absorbing all hydrocarbons. He concluded from it that poor gases gave to a system of incandescents the same illuminating power that rich gases gave.

He added even that the proportion of illuminating hydrocarbons, being relatively small, could exercise only a little serious influence on the calorific power.

We have demonstrated that this hypothesis was not correct, but we could not from the first throw in doubt the experiments on which the experimenter relied.

I have then repeated the experiments, adding thereto the heat of combustion of the gas.

	Ordinary Gas.	Decarbureted Gas.
Photometric Titre	107.9	143
Intensity of 5 feet	7.98	7.76
Heat of Combustion	273	270

We remark the relation existing between the figures.

The idea that heat of combustion corresponds rather to the intensities of the Auer burner, but differs totally in concordance of heats of combustion and of illuminating powers is not exact.

The explanation of it is easy: During their passage through the Colza oil, the hydrocarbons are replaced by traces of oil carried mechanically by the gas. The mixture, not being sufficiently intimate, does not burn in the Bengel burner, and in this case we have as illuminating power only that which belongs to the decarbureted gas.

It is entirely different with the Auer burner, for this mixture, if the oil be not in the state of gas, on arriving at the incandescent tissue, burns entirely, and we have in this way the intensity of a gas with enriching matters.

In the research on the heat of combustion of this mixture, we find not only that of the gas but also the units given by the oil, whence the larger number.

To prove it besides, it sufficed me to cause decarbureted gas to pass over cotton. We keep back thus a large portion of the oil absorbed by the gas. On extracting the cotton with carbon disulphide the oil may be recovered.

I will now show the diverse applications of the obus and the uses to which it may be put in the good work of a gas works. I have shown you the importance of this apparatus for the control of the quality of gas. It serves also to regulate the work of the gasogenes. Instead of making an analysis of combustible gas with the Bunte burette, it is easier and as rational to determine by calorimetric test the heat of combustion of the gas furnished by the gasogene. Here are, for example, two gasogenes working differently:

	Furnace No. 1.		Furnace No. 2.	
CO_2	8.4		6.0	
CO	18.4	24.1	27.0	33.2
H	5.7		6.2	

We see from this that the working of furnace No. 1, with 24 per cent. combustible gas, is not satisfactory.

Dulong's law would give us for the heats of combustion of the gases:

For No. 1	38
" 2	56

A quick determination with the obus has given us:

For No. 1	37
" 2	57

In receiving coal the obus may still render us great service by showing us the fall in calorimetric power, if the coal has been heated during transportation or if it has remained exposed a long time outside the mine.

The obus permits also rapid determination of the sulphur in the coal, in the coke, or even in the gas; for outside its role of calorimetric apparatus it is also an apparatus for chemical analysis. We see thus that the apparatus of Mr. Mahler, who has permitted me to present these tests on the value of gases from calorific points of view, opens to us a new and vast field of interesting studies in our work. That I have been able to give these researches and contribute a little for my part to the study of this question, I owe to the Gas Company of Marseilles, which, by its kindness in furnishing me the necessary apparatus, has greatly facilitated my task, for which I wish to thank it.

Matton's Overflow Device for Telescoping Gasholders.

On December 26 U. S. Letters Patent (No. 511,444) were issued to Mr. Frederick V. Matton, of Camden, N. J., for certain useful overflow devices for telescoping gasholders, the inventor subsequently assigning his interest to the Camden Iron Works. Using the words of the specification:

The invention is intended for use in connection with gasholders having two or more sections, and is designed to remedy some of the objections found in apparatus of this kind as at present constructed. The joint between the sections of the telescoping gasholders is formed by means of a circumferential trough, which extends outwardly around the bottom of the inner (or upper) section, and which fits into and engages with a corresponding inverted circumferential trough, extending inwardly around the top of the outer (or lower) section. The trough upon the inner section is filled with water, and the rim of the trough upon the outer

section, by dipping into this, enables the water to act as an efficient seal between the sections, so as to prevent the escape of gas from within. Devices of this character are open to the objection that when the sections are in their raised position, if the water in the trough be forced to overflow from any cause, it escapes at random over the top of the outer section and trickles down upon the sides thereof without control, thus being liable to occasion injury to the holder in winter time by freezing and accumulating in such manner as to interfere with the free and proper movement of the sections. The invention remedies these difficulties by providing a definite and localized internal overflow for the surplus water, of such character as to insure a proper seal under all circumstances, and which can be readily cleansed in case it becomes clogged.

In the accompanying drawings Fig. 1 represents a partial vertical section through the adjacent ends of two of the gasholder sections, showing the sealing troughs upon each, and the overflow device combined therewith. Fig. 2 is a front view of the overflow device, the rims of the troughs being represented as removed; and Fig. 3 is a top view of said device.

The vertical walls of the gasometer sections are represented at *A* and *B*, respectively, the inverted trough upon the outer or lower section *A* being formed by an inwardly projecting circumferential channel bar A^1, and the vertical rim *a* depending therefrom. The trough upon the

FIG. 1.

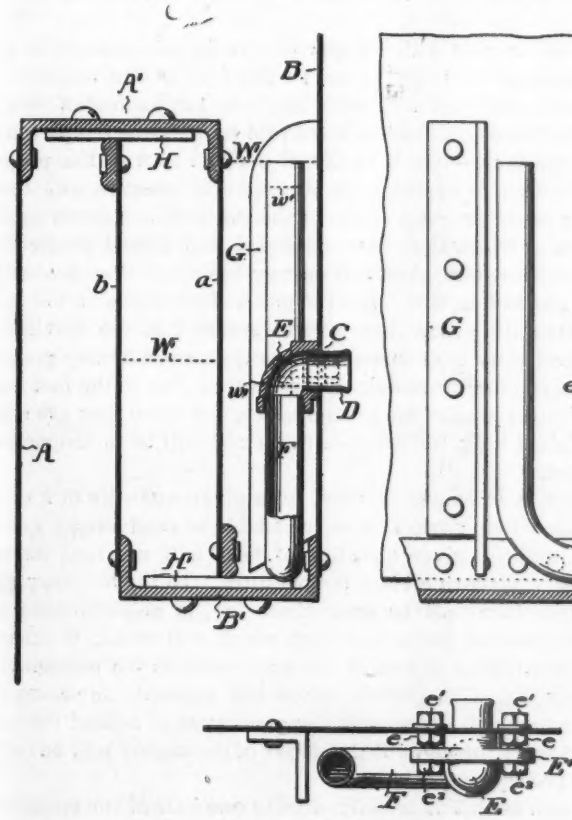


FIG. 2.

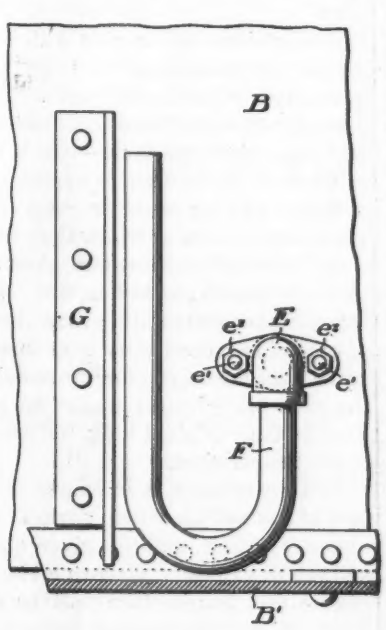


FIG. 3.

inner or upper section *B* is formed in a similar manner by means of an outwardly projecting circumferential channel bar B^1, provided with an upwardly projecting rim *b* corresponding in depth to the rim *a*. Transverse strips $H\,H^1$, respectively, are placed at intervals within the channels of the bars A^1 and B^1, against which the edges of the trough abut during the lifting operation. An aperture *C* is formed in the wall of the inner section *B*, at a point about half way down the trough, and an inwardly extending nozzle *D* is inserted freely through this aperture. Said nozzle screws into a flanged elbow *E*, which is secured upon the outside of the wall *B* by means of bolts $e^1\,e^1$, which are permanently fastened to the wall by means of jam nuts *e e*. The outwardly projecting ends of these bolts pass through the flange E^1 of the elbow *E*, which is clamped into position against the wall of the section by means of nuts $e^2\,e^2$. A U-shaped pipe *F* extends down from the elbow *E* to a point near the bottom of the trough, and thence upward to a point slightly below the top thereof. A guard piece *G* is secured to the wall of the section *B*, adjacent to the pipe *F*, and projects outwardly to an extent sufficient to cover said pipe, and thus protect it from injury which might otherwise occur through its being struck by the rim *a*.

The operation of the device is as follows: When the section *B* is in a raised position the water (which at the commencement of its upward movement completely filled the trough) will, of course, be forced to different levels on opposite sides of the rim *a*, and such change of level will necessitate an overflow from the trough. As the water rises outside of the rim *a* it will escape through the pipe *F* and be discharged at the nozzle *D* into the interior of the gasholder until a condition of stable equilibrium is reached, when the respective water levels in the troughs will be such as are indicated by $W^1\,W^1$, and in the pipe *F* by $w^1\,w^1$, respectively. It will thus be seen that the overflow which otherwise would have to take place over the outer surface of the channel bar A^1 is controlled and directed within the interior of the gasometer, so that none of the difficulties above mentioned can arise. Should the pipe *F* or the nozzle *D* become clogged, it is only necessary to unscrew the nuts $e^2\,e^2$, and lift away the pipe and its nozzle for cleaning, the aperture *C* being of course closed by means of a plug during such temporary removal.

The inventor claims:

1. The combination with the inner and outer gasholder sections having circumferential troughs arranged with relation to one another as set forth; of an overflow pipe situate in the trough of the inner section and leading to a point of discharge within the gasholder, substantially as set forth.

2. The combination with the inner and outer gasholder sections, having circumferential troughs arranged with relation to one another as set forth; of an overflow pipe situate in the trough of the inner section; and a discharge nozzle for said overflow pipe, leading through and detachably connected with the wall of the inner section, substantially as set forth.

3. The combination with the inner and outer gasholder sections having circumferential troughs arranged with relation to one another as set forth; of an overflow pipe situate in the trough of the inner section and leading to a point of discharge within the gasholder, and a guard plate adjacent to said pipe, substantially as set forth.

Practical Application of the Pyrometer.

Iron Age says that the growing necessity of uniformity in the quality of iron or steel products has caused a closer study of scientific phases when metal of specified ductility is required. Old methods of judging by the eye are fast becoming obsolete, and with the increasing use of the pyrometer to ascertain and regulate temperatures of furnaces, the old secrets of managers and others, who have passed them from one generation to another, do not possess their former value.

The pyrometer is by no means a modern instrument, but its utility and value are being daily demonstrated. In annealing malleable castings, sheets of iron and steel and other iron and steel products, it is required that a certain temperature be maintained in the furnaces for a given number of hours to produce a desired result. To accomplish this it has hitherto been the custom to train men in charge of furnaces so that they could make a tolerably accurate guess regarding the temperature by withdrawing a stopper and peeping into the furnace. This was a method full of uncertainties, and to make results more positive the pyrometer is now fast coming into general use.

For the benefit of those not having an available table at their command we print below the temperatures of iron, steel and other metals under various conditions, according to the very latest scientific investigation:

Temperatures.

		Degrees F.
Bright iron becomes	yellow	435
	red	500
	indigo	550
	gray	750
Tin melts		445
Mercury boils		660
Lead melts		612
Zinc melts		775
Silver melts		1,775
Copper melts		1,885
Gold melts		1,900
Iron bar, red, in	a dark room	950
	ordinary office	1,075
	daylight, open air	1,450
Cast iron melts	white	2,075
	gray	2,230
Annealing	malleable castings	1,600 to 1,750
	sheet iron No. 20 and lighter	1,600 to 1,700
	sheet iron Nos. 18 to 10, 1,750 to	1,800
Annealing glassware		800 to 1,000

	Degrees C.	Degrees F.
Bessemer process—		
Running the slag	1,580	2,876
Running steel into ladle	1,640	2,984
Running steel into mould	1,580	2,876
Annealing furnace, ingot in.	1,200	2,192
Ingot under hammer	1,080	1,976
Siemens Marten process—		
Gas from producers	720	1,328
Gas entering generator	400	752
Gas leaving generator	1,200	2,192
Air leaving generator	1,000	1,832
Fumes passing to shaft	300	572
End of fusion of charge, open hearth	1,420	2,588
Refining the steel	1,500	2,732
Running into ladle, first	1,580	2,876
Running into ladle, last	1,490	2,714
Glass furnace, between the pots	1,375	2,507
In the pots, refining	1,310	2,390
In the pots, working	1,045	1,913
Siemens, melted for casting	1,310	2,390
Blast furnace, Gray Bessemer—		
Front of tuyere	1,930	3,506
At tapping	1,570	2,858

By preserving this table and carfully using a pyrometer, those in charge of furnaces will avoid mistakes which are often very costly. It is frequently the case when new men are put to work at a furnace that they are entirely too energetic. The furnace is kept too hot and the material spoiled, annealing boxes are burned and general trouble results. On the other hand, an old employee, depending too much on his former success, may grow careless and keep the furnace at too low a temperature. The charge is drawn after the furnace is cooled down, the result is not satisfactory and the material has to go through the process a second time at the expense of the manufacturer. By using a pyrometer and enforcing a system of recording temperatures every hour these troubles can be avoided.

The Gas Engine as a Probable Motor in the Problem of Aerial Navigation.

A very interesting series of papers on the problem of aerial navigation, from the pen of the late Mr. C. W. Hastings, has just been brought to a close in *Aeronautics*. We abstract the following from the chapters on the motor:

The development of the motor will perhaps be the most costly part of the development of aerial navigation, and it will also be more largely a matter of empirical than of theoretical determination. It is probable that we have with fair approximation indicated in the preceding chapter how light this motor must be per horse power—that is to say, a minimum of 10 lbs. per horse power, and probably at most 15 lbs. per horse power, will do the work. A heavier motor than one weighing 15 lbs. for each horse power of energy developed will probably not answer. Now this weight of 10 or 15 lbs. must include the motor and all that pertains to make it complete. If it be an explosive engine, the weight of the necessary fuel for driving it and the water that will probably be necessary to keep it cool must be reckoned in with the 15 lbs., and if it be a steam engine, the weight of the boiler, the fuel and the water, as well as the engine proper, must be taken into account; if the engine be an electric motor, the source of the current, such as the battery, must also be included in the weight if the motor is to be considered complete.

We may, of course, drop the water motor out of the question, and this will then leave for consideration the piston and cylinder, or the rotary engine operated by the pressure of some kind of gas, and the electric motor.

The characteristics of any piston and cylinder engine which shall develop great energy in proportion to its weight will be high cylinder pressures per square inch and high piston speed in feet per minute, and also high economy, for the weight of the supplies of the engine must be reckoned with the total weight.

The power developed by any engine will be in proportion to the total pressure upon the piston multiplied by the speed of the piston, so it is evident that the engine which will develop the greatest energy in proportion to its weight will be the one which will have the highest rate of piston speed.

If the cylinder be merely proportioned to resist the bursting strain it will theoretically remain at the same weight for all pressures employed; but it cannot be so proportioned, and the frame necessary to hold a large cylinder, even if it be of the same weight as a small one, will be heavier than that required to hold the latter. The element of stiffness must be considered—the internal friction of a large piston is greater than that of a small one, etc.—so that the engine with the high pressure and the correspondingly small cylinder will be much smaller and lighter than the engine with the large cylinder and the low pressure.

The thoughts of many will turn to the gas or gasoline engine as being most available for the purposes of aerial navigation, for the reason that no special apparatus, such as a boiler, is required to develop the pressure; that it is unnecessary to carry any special fluid, such as water, to act as a medium for turning heat into mechanical motion, and that the fuel may be carried in a most convenient and compact form, such as gasoline, which will create equal energy with one-third of the fuel required by steam. But the gas or gasoline engine, as built at present, or in any modification of its present form, will be too heavy for the purposes of aerial navigation.

The greatest trouble with the gas engine is the extremely low pressures at which it is obliged to work; and although no special apparatus is needed to develop and store the pressure required, as in a steam engine, still, unless such a device is used, the pressure will not act upon the piston almost continuously, as is the case with the steam engine, but will only operate on the piston for one half or perhaps one quarter of the time.

The fundamental trouble with the gas engine in its inability to develop high pressures is the fact that the 1 cubic foot of the mixture of gas and air which is exploded will make less than 1 cubic foot of resultants of explosion if those resultants are reduced to the same temperature and atmospheric pressure—that is to say, if a cubic foot of the proper mixture of gas and air be exploded, at atmospheric pressure and temperature, and the resultant gases of the explosion be cooled down to the same temperature at which they were exploded and placed under the same (atmospheric) pressure, they will occupy less space than the original mixture of gas and air did. But the gases after explosion are at a much higher temperature than they were before, so that the resultants of explosion immediately after that action occupy a considerably greater space than the original mixture did. The pressure is due to the fact that the gases being heated occupy the greater space, and since they are confined to their original bulk, the pressure they exert will be in proportion to the temperature.

This temperature is, of course, limited, for a given quantity of a mixture of gas and air when burned is only capable of producing a given quantity of heat, and this given quantity of heat will not heat the resultants of explosion above a certain temperature. In the ordinary gas engine this temperature will be somewhere in the neighborhood of 2,500° F., and the pressure per square inch which will result, if the resultant gases are compelled to occupy the same space as the component ones, will be only about 75 pounds above the atmospheric pressure; and since the pressure will decrease as the gases expand behind the piston, the mean pressure throughout the stroke of the engine will be only about 40 pounds per square inch.

In an engine such as this it is only during one-half of the stroke of the piston that there is any pressure at all, for during the first half the inflammable mixture is being drawn into the cylinder. Now, the improvement which has greatly increased the efficiency of the gas engine is to compress the mixture of gas and air before explosion; but to do this requires a special pump, or else one stroke of the engine must be sacrificed, during which time it acts as a pump to compress the mixture of gas and air. There is, of course, a considerable heat developed by the explosion, and therefore special means must be taken to keep the working parts of the gas engine cool; this is done by water, the cylinder being jacketed so that it may be cooled by circulation of water around it. For this reason it has been found impracticable to use more than one end of the cylinder for working purposes. If the cylinder be inclosed at each end and the charges of gas and air exploded in each end, the piston becomes so hot as to prevent the operation of the machine. All of these mechanical difficulties can probably be overcome; but the limited pressures which can be employed, or the special means which must be employed if higher pressures are to be used, probably warrant the statement that the gas engine in its present form will never become the lightest prime mover for the energy it develops, and also that it can probably never be made light enough for the purposes of aerial navigation.

Although the gas engine will never probably be the lightest prime mover, still it may be that an explosive engine of some kind will be.

Fireproof Floors.

In a paper recently read before the Civil Engineers' Club of Cleveland, Mr. Wm. Sabin describes the forms of fireproof flooring most commonly adopted in this country. The oldest method was to place floor beams about 5 feet apart, and turn a 4 in. brick arch between them, the beams being tied together to resist the thrust of the arches. The space above the arches was levelled up with concrete, in which were bedded strips of wood for the flooring. The plastering was applied directly to the bottom of the arches and over the flanges of the supporting beams. When exposed to a fire, however, it soon cracked off, and a special tile skewback is now used. Such a floor weighs about 70 lbs. per square foot, exclusive of the weight of the floor beams. Its costs is about $1.44 per square foot. A similar floor in which the brick arch is replaced by one of corrugated iron has also been tried, but as the metal is exposed to the heat it has no advantages. Its weight is 70 lbs. and its costs $1.39 per square foot. The next improvement was the use of flat arches of terra cotta. In this case the beams were placed 6 ft. to 7 ft. apart, the ties being 10 in. deep, and the weight of the floor was reduced to 40 lbs. per square foot, and its cost to $1.34. A further reduction of weight was affected by the use of porous terra cotta, obtained by mixing saw dust with the clay. The weight of floor was thus brought down to 35 lbs. per square foot, whilst its cost was $1.36. In a test made at Denver an arch of porous terra cotta 4 ft. wide and having a span of 5 ft. bore a load of 15,145 lbs., with a deflection of 0.65 in., and it took 11 blows of a weight of 134 lbs. falling from a height of 6 ft. to 8 ft. to entirely destroy the arch. Both systems of terra cotta floor have successfully withstood severe fires. In a method of construction now being largely adopted, the span of the floor is increased to 12 ft., and it is supported by 12 in I beams. Between these beams is strained a galvanized wire net, said to be capable of carrying 1,000 lbs. per square foot. A center-board is fixed below this net, and the space between it and the top of the floor filled with a very light concrete made with crushed coke, cork, cement, and a little sand. This floor is 8 in. deep, the bottom flanges of the I-beams being protected by carrying the cement round them. Its weight is only 18 lbs. per square foot, and it has been tested with a load of 580 lbs. per square foot, the deflection being only one-half inch. Its cost is about $1.05 per square foot.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Captain J. W. Wilcox, who made an enviable record in connection with his works' management of the Macon (Ga.) Gas Light Company, has been elected City Engineer of Macon. He is sure to win additional fame in this position, and the corporation is to be congratulated on having secured his services.

The following is a copy of the resolutions passed by the Directors of the Penn Yan (N.Y.) Gas Light Company, at a meeting held on December 22d, at which time the resignation of Mr. T. W. Summers as Secretary and Superintendent was accepted :

Whereas, The Directors of the Penn Yan Gas Light Company have received the resignation of Mr. Thomas W. Summers, as Secretary and Superintendent of the same ; be it

Resolved, That his resignation be accepted with an expression of our good will and esteem, with regret that he cannot find it as profitable to remain with us as to do otherwise, and with the acknowledgment of his business integrity and valued services rendered us ; also, be it

Resolved, That we congratulate Mr. Summers upon his advancement to a more profitable field of labor, and the Augusta Gas Light Company, of Augusta, Georgia, upon securing as its Manager one whom we know to be so thoroughly equipped to serve it faithfully and well, hoping that the relations between them and Mr. Summers may be as pleasant as those between him and ourselves have been ; also, be it

Resolved, That a copy of these resolutions be furnished to Mr. Summers and the American Gas Light Journal.

We understand that Mr. John R. Lynn has succeeded Mr. Summers as Secretary and Superintendent of the Penn Yan Company.

On Christmas day Mr. J. F. Seamon, Manager of the United Light Company, of Uniontown, Pa., was presented by the employees of the Company with an onyx and brass stand. The flattering words that preceded the presentation were neatly responded to by Mr. Seamon, who assured his auditors that their faithfulness to the Company and to him as its representative was fully appreciated.

Attorney General Rosendale's last official decision was rendered on December 30th, in the instance of the application of the Peoples Gas Light Company, of Brooklyn, for leave to have actions begun to vacate the charters of the Greenpoint and Williamsburgh Gas Light Companies. He refused the motion.

The full text of the petition presented to the Board of Gas and Electric Light Commissioners for a rehearing of the Chelsea (Mass.) Gas Light Company, in the matter of the decree of the Commission ordering the Company to reduce its selling rate to $1.65 per 1,000 cubic feet, is appended :

To the Board of Gas and Electric Light Commissioners : Gentlemen—At a special meeting of the Board of Directors of the Chelsea Gas Light Company, the report of the Board of Gas and Electric Light Commissioners, on petition of the Mayor of Chelsea and more than 20 consumers of the Chelsea Gas Light Company, for an improvement in the quality of gas and a reduction in the price of gas to $1.50 per 1,000 feet was read and considered. On motion it was voted that the President of our Company be, and he hereby is, directed to petition the Board of Gas and Electric Light Commissioners for a rehearing, at your earliest convenience, on the question of the reduction of the price of gas as recommended in your report, and also that our Company be allowed the same rights relative to a discount for prompt payment on bills as is at present allowed by your Board to a large majority of the Gas Companies of the Commonwealth. Our Company petitions for the above for the following reasons :

1. Because the adoption of your recommendation to fix the price of gas at $1.65 per 1,000 feet will compel the Company to reduce its dividend from 5 per cent., the present rate, to at least 4 per cent.

2. That while theoretically a reduction in the price of gas means increased consumption, the history of the Company shows that reduced price means reduced consumption. Your Board in its report upon the petition above referred to, of November 10th, 1893, admits this fact, as shown in the following language in said report : "In the five years prior to July, 1893, the Company has reduced the price of gas hearly 20 per cent., but the increase in output during the entire period has been only 2 per cent. The last reduction went into effect July 1, 1891, and the output for the year following was in fact less than for the preceding year. During the period named the profits have steadily diminished, and for the year ending July 1st, 1893, were about $10,000 less than for the year ending July 1st, 1888. There is but one city in the State of similar size where the consumption of gas is so small, although in some of them the price is as high or higher. These facts are important and compel serious consideration. They afford strong ground for the Company's position that the field which it occupies is governed by exceptional conditions." Although our Company has, as your Board states, reduced the price of gas nearly 20 per cent., and upon several occasions without any petition therefor, it has yet to find a single instance of a consumer who used illuminants other than gas who was induced to use gas in place of the same by reason of a reduction in the price.

3. The Company respectfully submits that in fairness to its stockholders, many of whom are widows and children, that the price of gas should be so fixed as to allow a reasonable return for capital invested, and at the same time allow the Company a profit sufficient to cover depreciation and the maintenance of its plant, and enable the Company to take advantage of every economy in the manufacture of its product.

4. The criticisms made by your Board in a former report (January, 1891) in relation to an inflation of capital in the earlier history of the Company, was duly considered by your Board in its report of that year recommending a reduced price for gas. The inflation of stock, the last of which was made 20 years ago, never exceeded $50,000, and more than $53,000 has been expended in construction during the last 12 years, and the same charged to profit and loss account. No individual at present connected with the Company has been in any way benefited by this inflation. Those who were benefited, if any, are now deceased. The present Board of Directors are satisfied with a dividend of 5 per cent., and also that any surplus over that amount should be used in reducing the price of gas and benefiting the plant.

5. The question of leakage has been a serious one, and the Company has expended the present season over $4,000 in repairing its pipes, cutting off street lanterns, etc., so that the loss by leakage might be reduced to a minimum.

6. We respectfully submit to your Board that the allowance of a discount on bills to the consumer so as to bring the price for prompt payment to a net price recommended by your Board is no hardship to him; that unless such gross price can be exercised by the Company it cripples us in our ready resources and necessitates the constant employment of a

collector, thus adding to the cost of our product. We understand that this right of discount for prompt payment is to-day exercised by 90 per cent. of the Gas Companies of this commonwealth under your supervision. We respectfully submit that this should not be denied us. WILLIAM G. PECK, President.

THE Fogarty Gas and Chemical Company has been incorporated at Chicago by Messrs. Ambrose A. Woesley, N. H. Hanchette and John C. Salterlee. It is capitalized in $10,000,000, and proposes to exploit the inventions of Mr. Thomas B. Fogarty, who aims to cause gas to become a residual product.

THE Hartford (Conn.) City Gas Light Company has declared the usual semi-annual dividend of 4 per cent.

ACCORDING to the Company's Engineer, Mr. Waltham, the damage to the holder of the York Light and Heat Company, of Biddeford, Me., which was said to have been totally destroyed by an explosion last month, can be repaired for $3,000. This estimate also includes repairs to the tank.

THE following are the awards made by the city of Philadelphia for its public arc lighting for the ensuing year :

Company.	No. Lights.	Price per Night, each.
Powelton	300	45 cents.
Kensington	156	45 "
Manufacturers'	38	45 "
"	165	50 "
Wissahickon	93	50 "
Suburban	217	55 "
Germantown	116	52½ "
Southern	303	45 "
"	202	47½ "
"	54	38 "
Diamond	87	45 "
"	50	50 "
"	73	40 "
Brush	1356	39 "
"	217	28 "

THIS year the assessment levied by the corporation on the Consumers' Gas Company, of Toronto, Canada, for the purposes of taxation was increased in the sum of $500,000, which increase is explained by the assessors that the value of the Company's mains and services and gasholders has been taken account of, instead of having been omitted as heretofore. The Company has lodged an appeal.

"OBSERVER" forwards the following: "At a special meeting of the shareholders of the Salem (Mass.) Gas Light Company, called for the purpose of electing a Treasurer in place of David Moore, resigned, Col. Henry A. Hale presided. A ballot resulted in the unanimous choice of Mr. Benjamin W. Sluman, who has been Clerk of the Company for a long time. Alderman Arthur W. West submitted resolutions which were unanimously adopted, thanking Mr. Moore for his faithful services as Treasurer, which covers a period of 29 consecutive years."

THE Cincinnati Gas Light and Coke Company has issued circulars notifying those interested that a meeting of the shareholders will be held on January 22, at the Company's offices, for the purpose of voting on a proposition to increase the capital stock from $7,500,000 to $8,100,000, the increase to be devoted to absorption of the stock of the Cincinnati Electric Light Company. The par value of the Electric Light Company's stock is $5, and that of the Gas Company $100, and holders of the former are to receive in exchange for 20 shares one share of the latter, each to be rated at par in the transfer.

ON motion of Alderman Amazeen, the Common Council of Haverhill, Mass., has voted "that it is expedient for the city to construct and maintain plants for the manufacturing of gas or electricity in accordance with the provisions of Section 1, Chapter 371, Acts of 1891."

AT the annual meeting of the Ilion and Mohawk (N.Y.) Gas Light Company the following officers were elected: Directors, Thomas Ringwood, C. W. Carpenter, A. N. Russell, A. E. Brooks, John Hoefler, J. V. Schmidt, F. C. Shepard, H. D. Alexander and E. B. Schmidt; President, Thomas Ringwood; Vice-President, John Hoefler; Treasurer, C. W. Carpenter; Secretary, J. V. Schmidt.

AT the annual meeting of the Metropolitan Gas Light Company, of Brooklyn, N. Y the officers chosen were: Directors, Alexander E. Orr, Henry D. Polhemus, Felix Campbell, John H. Davis, Hugh McLaughlin, J. Edward Addicks, Henry H. Sheldon, C. H. Stoddard, J. C. Bergen and Arthur F. Staniford; President, Alexander E. Orr, replacing Mr. Stoddard, who has been President of the Company for some years; Vice-President, J. E. Addicks; Secretary, Arthur F. Staniford. This result certainly seems to point to much closer relations between the old Brooklyn and Metropolitan Companies, for the management of each is now practically identical. It also proves that Mr. Addicks is a potent factor in Brooklyn gas circles, and seems to show that consolidation is close at hand.

THE St. Paul (Minn.) Gas Light Company gave to each of each of its employees a Christmas turkey. It took a carload of the toothsome fowls "to go around."

A "TRAVELLING MAN" sends the following from San Antonio, Texas, dated December 27th: "The investment of capital in great enterprises for the public benefit is always accompanied with special privileges and extra inducements. To furnish light for a city requires the expenditure of large sums of money; as an inducement to engage in such an enterprise the city becomes a customer, and grants franchises to use the streets, etc. The San Antonio Gas and Electric Light Company dates its commencement back to and before the war, before the day of telegraphs and railroads; its original incorporators, Messrs. S. R. Dickinson, J. C. French, James Vance, Asa Mitchell, H. L. Radaz and L. Colquhoun are all dead; the men who now stand in their shoes are of the young blood of the modern city of San Antonio. The old Company was granted a 50 year franchise to use the streets upon certain conditions, to wit: That the Company should furnish the city gas for street lamps at a price 10 per cent. less than is charged to private individuals, and shall not be authorized to charge more than $7 per 1,000 cubic feet of gas from and after the construction of any railroad from or to San Antonio, passing a terminal within 5 miles of a coal bed. The conditions have all changed with the advance of the times, and the old Company is now known as the San Antonio Gas and Electric Light Company. The Company had but fairly started out; how they made gas remains a mystery—cotton seed was utilized. The war paralyzed everything; of course gas was not needed, and peace found the Gas Company a financial wreck. After reconstruction the Company started operations under difficulties; the city was the only customer; the people relied upon the cheaper substitutes for light. The stock of the Company sold for 10 cents on the dollar, but the men engaged in the enterprise put in capital and things changed; a few years of prosperity brought the stock to par, then came opposition. Electric lighting came into vogue and an electric light plant was put up which brought the old Company into sharp competition; for six years no dividends were declared. The old Company bought out the opposition and now monopolizes the business. Besides the gas works on the San Pedro, a large electric light plant has been built on the river above the old mill on La Villetta street. Three Corliss engines furnish 1,400 horse power to 23 dynamos. The city is lighted with electric lights furnished to the people at rates that compare favorably with those ruling in other cities. Power is also furnished to three lines of electric cars, on the West End, Alamo Heights and Citizens roads. An artesian well has been bored that furnishes water to the boilers and discharges one million gallons of water daily. No other institution so fully represents the growth of San Antonio as does the Gas and Electric Light Company. It has grown rapidly to fill the demands of a modern community, and comparing the Company of 1860 with that of 1893 gives the reader an idea of the strides made in the past 30 years. The Company is now working under a three years' contract with the city, and there is a controversy between the city and the Company as to the price of street lighting. To meet the demands made upon it the Company has been compelled to expend large sums of money and is just now in a comparatively perfect shape. The proprietors contend that it would be injustice to force them to lower their rates below an earning point, while they are willing to make concessions within their power. It is so much of a home institution and has been so long associated with the fortunes of San Antonio, that justice would seem to dictate liberal dealing with the men who have so generously embarked their capital in building up one of the most complete plants in the State."

MR. HENRY CLAUSEN, JR., a Director in the Consolidated Gas Company of this city, died on December 28th. He was in his 58th year.

WE are indebted to Mr. W. W. Goodwin, of Philadelphia, for the appended notice of the late Dr. Charles M. Cresson, a brief minute of whose demise was published in our last issue: "Charles M. Cresson, M.D., was the only son of the late John C. Cresson and Letitia L. Cres-

son, of Philadelphia. He was born February 3d, 1828, in Cheltenham township, Montgomery county, Pa. At an early age he was sent to school at Burlington, N. J., and at the age of 10 years he was admitted to the Central High School, at its opening, October, 1838. His scientific and technical studies were largely directed by Drs. Robert Hare, J. K. Mitchell, A. Dallas Bache and Profs. Patterson and Frazer. His practical education in topography and civil engineering was obtained from S. W. Roberts and J. C. Trautwine. He was a graduate of the University of Pennsylvania, and graduated in medicine from the Jefferson Medical College in 1849. Dr. Cresson early made a special study of chemistry. He was Manager and Chemist to the Philadelphia gas works from 1849 until 1864, and for 15 years Chemist to the Philadelphia Board of Health, and also to the Fairmount Park Commission. He was an active and prominent member of the Franklin Institute since 1849, and of the American Philosophical Society since 1857. Dr. Cresson opened the scientific department of the Pennsylvania Railroad Company and of the Philadelphia and Reading Company 1868 and 1869, and that of the Baltimore and Ohio Railroad Company in 1883. During his early youth a considerable part of his time was devoted to mechanical and architectural drawings for the Philadelphia gas works and in the work of its chemical laboratory. Later he was elected First Assistant Engineer of these works, his duty being the construction of new work, until 1855, when the whole of the management of the mechanical and manufacturing departments devolved upon him. Dr. Cresson was, at the time of his death, one of the oldest gas engineers especially educated for the business in this country. Among other branches of chemical science that of photography early attracted his attention, and from the exhibition of the first daguerreotype up to the present time he has maintained his familiarity with the current improvements in that art. He devoted much time to the study and examination of waters, chemically and microscopically, and successful determinations of the causes of disease carried by the water supply of cities and towns have been actively engaging his attention. Some years ago he was a frequent contributor to the columns of the JOURNAL, and he published from time to time pamphlets upon 'The Manufacture of Gas,' 'Explosion of Steam Boilers,' 'The Effects of Electricity upon the Tensile Strength of Iron,' 'Wood Preservation,' 'Paper Manufacture,' and 'Water Supply of Cities.' He was connected with many Masonic bodies, having been at times E. C. of Philadelphia Commandery, No. 2, K. T., also E. C. of St. Alban Commandery, Past Master of Pennsylvania Lodge, No. 380, and various other bodies. Added to the rest of his accomplishments he was a skilful musician, having mastered the study of music at an early age, and having for many years given his services as organist to the Church of the Atonement. He was a charitable and amiable man, and numbered many friends. He leaves a widow. The funeral services were celebrated on the afternoon of Friday, December 29th."

THE improvements on the works of the Alexandria (Va.) Gas Company have resulted in a marked increase in the service and in the send-out, the consumers evidently appreciating the efforts of the proprietors to keep the plant up to the times.

THE recent experiences of the proprietors of the Spencer (Mass.) Gas Company with the fire fiend have prompted them to order an iron roof for their generating house, the contract for which has been placed with the Berlin Iron Bridge Company.

THE Superior (Wis.) Water and Light Company has filed suit in the District Court of St. Paul, Minn., against William and James Forrestal, of St. Paul, to recover $25,511.06 for alleged breach of contract. The complaint alleges that in June, 1890, plaintiff and defendant entered into a contract whereby defendants agreed to lay all water and gas mains in Superior to be laid by plaintiff during the season of 1890. Defendants accomplished a portion of the work and abandoned it in July, refusing to go on. Defendants gave no reason for such refusal, it is claimed, and plaintiff was obliged to complete the work. The Company was, by reason thereof, obliged to pay $25,511.06 more than it would have been obliged to pay under the contract, and therefore sue Forrestal Brothers for the amount.

A MORTGAGE amounting to $40,000 has been placed by the Hartford (Conn.) City Gas Light Company on its properties with the Travellers' Insurance Company. This is intended to cover part of the expenditure incurred in the construction of its new office building, which is well along to completion.

JUSTICE CLEMENT, in the City Court of Brooklyn, N. Y., some days ago heard testimony in a suit brought by the Continental Iron Works against the International Gas Company and the Citizens' Gas Company, of Brooklyn, to recover judgments amounting to perhaps $80,000. The suit springs from a contention as to which Company should pay for work done on the plant of the Union Gas Company, which company, at the time of the making of the contract (September 27th, 1890) was controlled by the International Gas Company. Since then the Union Company was consolidated with the Citizens' Company.

THE gas rate in the village of Green Island, N. Y., the gas supply of which is furnished by the Troy Gas Company, has been reduced to $2 per 1,000, a cut of 25 cents.

ON December 27th, the Common Council of Philadelphia passed a resolution reducing the gas rate to $1 per 1,000 cubic foot. This, however, is not final, the other branch of the city legislative government having decreed that the rate should be $1.25 per 1000.. Conferences, we presume, are now in order.

THE proprietors of the all but-defunct Syracuse (N. Y.) Steam Heat and Power Company have applied to the Council for a franchise permitting them to supply electric currents for light and power.

A SUIT in equity in the Supreme Judicial Court, Massachusetts, has been brought by Otis D. Dana, Renj. Dean and other minority stockholders of the South Boston Gas Light Company against J. E. Addicks, W. E. L. Dillaway, Samuel Little, E. C. Fitz, F. P. Addicks, as officers, directors and majority stockholders, of the South Boston, Bay State, Boston, Roxbury and Dorchester Gas Light Companies, and the Bay State of New Jersey, Bay State of Delaware, the Mercantile Trust and Beacon Construction Companies. The bill charges defendants with having fraudulently conspired to cheat and defraud the minority stockholders of the South Boston Company, and sets forth a number of breaches of trust and avers various illegal actions on the part of defendants, by which plaintiffs have suffered great loss and damage and the charter of the South Boston Company has been put in jeopardy. The bill prays that said officers, directors, etc., may be removed from office and from control of the Company, that a receiver may be appointed and that the Company may either be reorganized or wound up. The Court ordered the defendants to appear within one month from the first Monday in January to answer plaintiffs' bill.

THE Montreal Gas Company has entered a protest against the action of the City Council in awarding a contract for the public lighting of the city to the Company represented by Messrs. John Coates & Co., which protestant claims interferes with its rights in the premises. The protest avows the intention of holding the city "responsible for all costs, losses, damages, injury and detriment that may in any way be suffered and incurred by the Montreal Gas Company through and by reason of any violation by the said city of any of the terms and conditions," etc.

HERR DICKE, of Berlin, having conducted a series of experiments to determine the relative heating efficiencies of coal gas and non-carbureted water gas, reports that in heating stoves and cookers the ratio of efficiency between coal gas and water gas is about 1,000 : 588 ; so that water gas at 33.84 cents per 1,000 cubic feet is equivalent to coal gas at 57.54 cents.

Effect of Temperature on Iron.

An official statement of tests made at the Massachusetts arsenal to attain the effect of temperature on the strength of iron has been published. The specimens were heated by rows of Bunsen burners, which were arranged in a muffle, and the temperatures of the test specimens were judged by their observed expansions. Each piece was heated to the temperature of the test before being strained, and its expansion determined by a micrometer, and the coefficient of expansion of each grade of metal having been determined before the tests began, the temperature could be inferred with considerable precision. An abstract of five of these tests—the temperatures being all on the Fahrenheit scale—is in evidence that the strength of steel is greater at about 500° than it is at 70°.

These five series of tests were made with five different qualities of steel containing respectively 0.09, 0.20, 0.31, 0.37, 0.51 per cent. of carbon, and the percentage of strength was obtained by dividing the tensile strength of a sample of steel at the given temperature by the strength of the same quality of steel at 70°. The result presents the interesting fact that the specimens in question were all stronger in the neighborhood of zero than they were at ordinary temperatures—all of them, in fact, showing a minimum of strength at 210° or thereabout, and a maximum of strength at about 550°.

The Market for Gas Securities.

Dullness and lack of strength are the dominant conditions in the city gas share market, the opening price to day (Friday) for Consolidated being 122½ bid, 125 asked, with no indication that prices are likely to improve in the near future. The state of the market is decidedly puzzling, and it is extremely difficult to assign a cause for the weakness in Consolidated. Putting one thing with another, the most likely reason is the fear of untoward legislation this winter in the matter of gas rates, and should the dominant party unseat the required number of Democrats to secure a two-third vote in the Senate and House, thus enabling the Republicans to pass any measure over the Governor's veto, the prospect for dollar gas in New York and Brooklyn is more than an even chance. Brooklyn shares are weaker, although the weakness is not reflected particularly in the quotations, which are nominal. The Peoples Company and the Williamsburgh Company have come to an understanding, wherefore all legal proceedings have been dropped. We soon ought to hear something positive about consolidation, and we still advise the purchase of old Brooklyn, at 115 or under. Chicago gas is in better demand, Baltimore Consolidated is fairly steady, at 53¾ to 54, and Bay State is very much weaker, at 11½ to 12.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

January 8.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	122½	125
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	190	195
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	145	150
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	50	65
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	—	32
Preferred	5,000,000	100	—	77
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	115
Citizens	1,200,000	20	57	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	25	40
Fulton Municipal	3,000,000	100	130	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	80	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	—	140
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	145	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	11½	12
Income Bonds	2,000,000	1000	40	—
Boston United Gas Co.—				
1s Series S.F. Trust	7,000,000	1000	77	79
2d " " "	3,000,000	1000	57	58
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	62	62¼
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Consumers Gas Light Co., Jersey City	2,000,000	100	—	30
Bonds	600,000	1000	—	85
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	53¼	54
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			45	—
East River Gas Co., Long Island City	1,000,000	100	—	—
Bonds	500,000	100	86	87
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	15	16
Preferred "	2,500,000	100	60	70
Bonds	9,034,400	1000	80	82
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	30	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			42⅝	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City		—	160	170
" " Bonds			—	—

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City 61
Wm. Henry White, New York City 67
Fred. Bredel, New York City 63
H. C Slaney, New York City 61
Geo. R. Rowland, New York City 61
Jas. R. Smedberg, Chicago, Ills 61

CHEMISTS.

E. G. Love, New York City 58

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md 65
United Gas Improvement Co., Phila, Pa 57
Burdett Loomis, Hartford, Conn 67
National Gas and Water Co., Chicago, Ills 59
Economical Gas Apparatus Construction Co., Toronto, Ont. 58
The Western Gas Construction Co., Fort Wayne, Ind 58

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City 67
Continental Iron Works, Brooklyn, N. Y 52
Deily & Fowler, Phila., Pa 67
Kerr Murray Mfg. Co., Fort Wayne, Ind 64
Stacey Mfg. Co., Cincinnati, Ohio 67
Bartlett, Hayward & Co., Baltimore, Md 65
Davis & Farnum Mfg. Co., Waltham, Mass 64
R. D. Wood & Co., Phila., Pa 66
Bouton Foundry Co., Chicago, Ills 51
Isbell-Porter Company, New York City 66
Fred. Bredel, New York City 63
United Gas Improvement Co., Phila., Pa 57
Berlin Iron Bridge Company East Berlin, Conn 54
National Gas and Water Co., Chicago, Ills 59
Economical Gas Apparatus Construction Co., Toronto, Ont. 58
The Western Gas Construction Co., Fort Wayne, Ind 58

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio 69
M. J. Drummond, New York City 69
R. D. Wood & Co., Phila., Pa 66
Warren Foundry & Machine Co., New York City 69
Donaldson Iron Co., Emaus, Pa 69
Addyston Pipe and Steel Co, Cincinnati, O 69

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City 63

GAS COALS.

Penn Gas Coal Co., Phila., Pa 61
Perkins & Co., New York City 60
Despard Coal Coal, Baltimore, Md 61
Westmoreland Coal Company, Phila., Pa 61
J. & W. Wood, New York City 60

CANNEL COALS.

Perkins & Co., New York City 60
J. & W. Wood, New York City 60

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio 61

COKE CRUSHER.

C. M. Keller, Columbus, Ind 60

INCLINED RETORTS.

Parker-Russell Mining and Mfg. Co., St. Louis, Mo 62

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J 62
B. Kreischer & Sons, New York City 62
Adam Weber, New York City 62
Laclede Fire Brick Mfg. Co, St. Louis, Mo 62
Borgner & O'Brien, Phila., Pa 62
James Gardner, Jr., Pittsburgh, Pa 62
Henry Maurer & Son, New York City 62
Baltimore Retort and Fire Brick Co., Baltimore, Md 62
Parker-Russell Mining and Mfg. Co., St. Louis, Mo 62
Brooklyn Fire Brick Works, Brooklyn, N. Y 63
F. Behrend, New York City 51

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y 62
F. Behrend, New York City 51

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y 63

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass 53

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City 68
R. D. Wood & Co., Phila., Pa 66
James R. Floyd & Sons, New York City 68
Continental Iron Works, Brooklyn, N. Y 52

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md 65
Fred. Bredel, New York City 63
J. H. Gautier & Co., Jersey City, N. J 63
Parker-Russell Mining and Mfg. Co., St. Louis, Mo 62

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 59
Wilbraham Baker Blower Co., Phila., Pa 59

GAS GAUGES.

The Bristols' Mf'g. Co., Waterbury, Conn 58

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page's Sons, N. Y. City 32

AMMONIA CONCENTRATOR.

Michigan Ammonia Works, Detroit, Mich 51

GAS METERS.

John J. Griffin & Co., Phila., Pa 70
American Meter Co., New York and Philadelphia 71
The Goodwin Meter Co., Philadelphia, Pa 36
Helme & Mellhenny, Phila, Pa 71
D. McDonald & Co., Albany, N. Y 71
Nathaniel Tufts, Boston, Mass 70
Maryland Meter and Manufacturing Co., Baltimore, Md 70
Harris Bros. & Co., Philadelphia, Pa 70
Metric Metal Co, Erie, Pa 69

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City 66
Continental Iron Works, Brooklyn, N. Y 52

BURNERS.

C. A. Gefrorer, Phila., Pa 52
Moses G. Wilder, Phila., Pa 51

STREET LAMPS.

J. G. Miner, Morrisania, New York City 63
Bartlett Street Lamp Mfg. Co., New York City..... 63

PURIFYING MATERIAL.

Connelly Iron Sponge and Governor Co., New York City... 59
Greenpoint Chemical Works, Brooklyn, N. Y..... 59
Henry W. Douglas, Ann Arbor, Mich..... 59
Read, Holliday & Sons, Ltd., New York City..... 51

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City..... 67
Fort Wayne Electric Co., Fort Wayne, Ind..... 915

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind..... 56
Isbell-Porter Company, New York City 66
Wilbraham Baker Blower Co., Philadelphia, Pa..... 59
Connelly Iron Sponge and Governor Co., New York City ... 59
The Connersville Blower Co., Connersville, Ind..... 56

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y..... 51
Chapman Valve Manufacturing Co., Boston, Mass..... 51
R. D. Wood & Co., Phila., Pa..... 66
Continental Iron Works, Brooklyn, N. Y..... 52

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa..... 72

ENGINES AND BOILERS.

The Hazelton Boiler Co., New York City..... 53

PURIFIER SCREENS.

John Cabot, New York City..... 58

GAS STOVES.

American Meter Co., New York and Philadelphia..... 55
The Goodwin Meter Co., Phila., Pa 36
George M. Clark & Co., Chicago, Ills..... 53
Maryland Meter and Manufacturing Co., Baltimore, Md.... 76
The Schneider & Trenkamp Co., Cleveland, O..... 52

PATENTS.

H. B Willson & Co., Washington, D. C..... 51

DIVIDEND NOTICE.

THE UNITED GAS IMPROVEMENT COMPANY,
DREXEL BUILDING, PHILA., Dec. 29, 1893.

The Directors have this day declared a quarterly dividend of two (2) per cent. ($1 per share), payable on January 15, 1894, to stockholders of record at close of business January 2. Checks will be mailed.

970-1 EDWARD C. LEE, Treasurer.

Situation Wanted

By a young man of seven years' experience

In Taking Meters and Statements, Setting Meters, etc.

Can run a gas works. A 1 references. Address, with terms.
970-1 "J. M. J.," care this Journal.

WANTED,

A First-Class Draughtsman.

Must be thoroughly conversant with coal gas machinery. State previous employers and experience. None but first-class need apply.

966-tf Address, "X," care this Journal.

F. BEHREND,

SOLE IMPORTER OF THE CELEBRATED

German (Stettin-Didier) Clay Gas Retorts,

BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,

Stettin "Anchor" & "Eagle" Brand Portland Cement

10 & 12 Old Slip, New York.

PATENTS

We secure United State and Foreign Patents, register Trade-Marks, Copyrights and Labels, and attend to all patent business for **moderate fees.** We report on patentability free of charge. For information and free hand-book write to **H. B. WILLSON & CO.,** Attorneys at Law, Opp. U. S. Pat. Office. **WASHINGTON, D. C.**

Valuable Gas Interest For Sale,

The undersigned will sell, to the extent of $20,000 to $50,000, in sums to suit purchaser, an interest in a growing gas business now netting 8 per cent; increase this year will give net earnings of over 12 per cent. Money wanted for extensions to cover valuable territory. A magnificent opening for a party desiring a permanent occupation and investment in one of the most pleasant residence locations in California. Banks and business firms as references. Address for particulars and statement,

LOS ANGELES SAFE DEPOSIT AND TRUST CO.,
Stimson Block, corner Third and Spring Streets.
954-tf Los Angeles, California.

THE LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ½ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

SEND FOR CIRCULAR.

ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

OFFICE AND WORKS:

938 to 954 River St., & 67 to 83 Vail Av., TROY, N. Y.

Read, Holliday & Sons, Ltd.

No. 7 Platt St., N. Y. City.

HYDRATED OXIDE OF IRON

For Gas Purification.

Analysis, Samples and Particulars on Application.

MOSES G. WILDER,

Mechanical Engineer,

816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors, Governor Gas Burners, Gas Cocks and Fittings.

In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters.* The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

Bouton Foundry Co.,

FOUNDERS AND MACHINISTS,

CHICAGO, ILL.

Gas Works Apparatus,

PURIFIERS, CONDENSERS,

Bench Work

SPECIALS. LAMP POSTS,

SCRUBBERS,

Iron Roofs and Floors.

Plans and Estimates furnished for new works or extensions of old works.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th St., Phila., Pa.

GASHOLDER PAINT.

Use Only

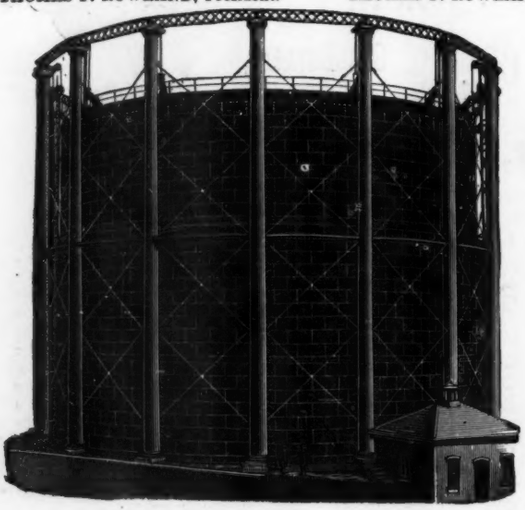
THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO. 104 High Street, Boston, Mass.

The Continental Iron Works

THOMAS F. ROWLAND, President. THOMAS F. ROWLAND, JR., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.



BROOKLYN, N. Y.

TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM NEW YORK TO GREENPOINT.

BUILDERS OF

GAS HOLDERS.

Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc., Etc.

SELF-SEALING RETORT MOUTHPIECES & LIDS.

For Round, Oval, or "D" Retorts.

Reliable Gas Heaters, Parlor Grates and Radiators.

Three Distinct Lines.

Sixty Different Styles.

Ranging in Price from

$5.00 to $30.00.

Send for 1894 Catalogue of Heating Stoves.

New Designs and

Improvements for 1894.

The Largest and Most Complete Line ever Manufactured Under one Name.

The SCHNEIDER & TRENKAMP CO.,

Sole Manufacturers of Reliable Gas Heaters. **479-501 Case Ave., Cleveland, Ohio.**

Jewel Gas Heating Stoves
For 1893-94.

Send for Catalog of the Most Artistic Line of Heaters on the Market.

The New Double Reflector is Worthy of Attention.

22 Styles. Prices from $4.50 to $12.

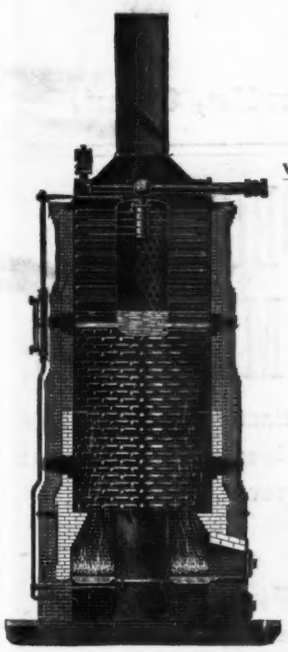
GEORGE M. CLARK & COMPANY,

MAKERS,

149-161 Superior St., Chicago.

The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

Patented in America and Abroad.



UPWARDS OF

100,000 HORSE POWER

of this Justly Celebrated Water-Tube Boiler in Successful Operation in all the Principal Industries.

An Unparalleled Record, of many years for Economy, Durability, Safety and Efficiency.

A Common-Sense High-Pressure Boiler made in a Superior Manner in our own Works.

We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

THE HIGHEST STANDARD OF EXCELLENCE.

Standard Sizes, 50 H.P. to 500 H.P.

THREE REGISTERED
THE HAZELTON BOILER.

THE PORCUPINE BOILER.
TRADE MARKS.

Special Waste-Heat Boilers for Roller and Other Mills

All Genuine Boilers of this Type bear our Three Registered Trade Marks.

BEWARE OF IMITATIONS.

Write for Illustrated Catalogue. Correspondence Solicited.

This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.

ESTABLISHED 1884. INCORPORATED 1888.

FOUNDED BY JOHN P. KENNEDY & SONS.

E. S. T. KENNEDY, President.
W. T. KENNEDY, Vice President.
J. B. REEVE, Secretary.

THE HAZELTON BOILER CO., Sole Proprietors and Manufacturers **716 E. 13th St., New York, U.S.A.**

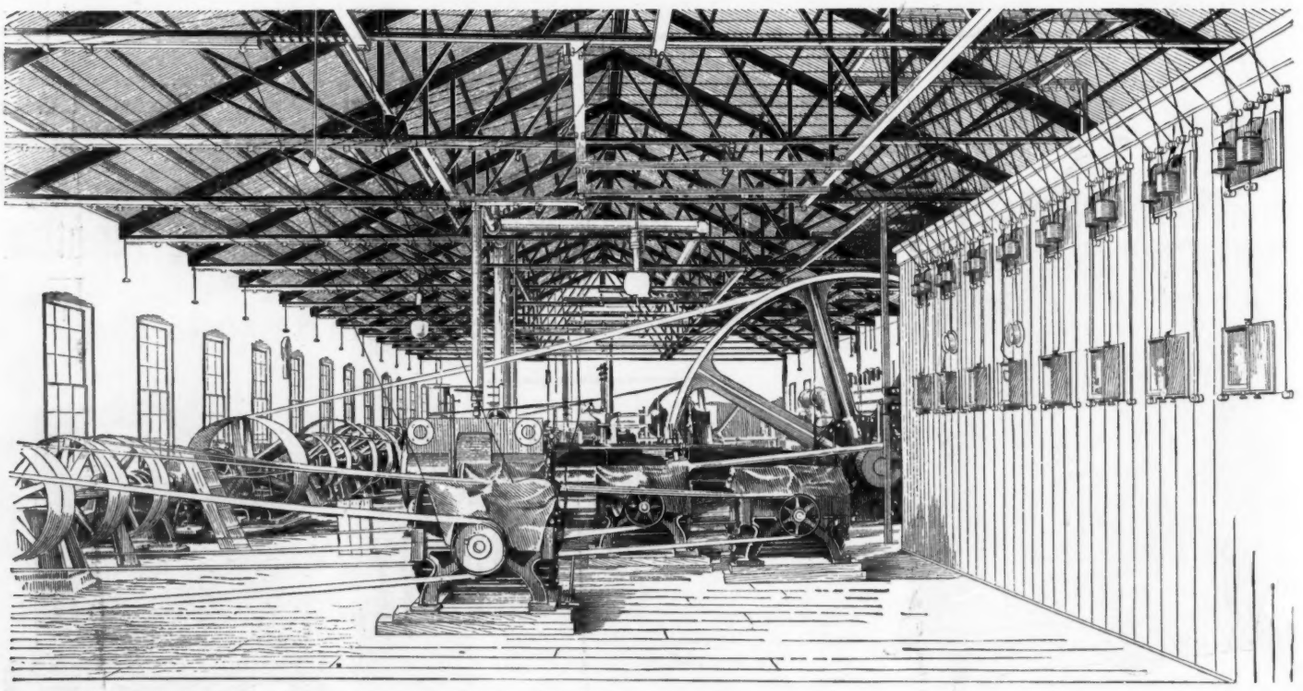
The Original and Only Manufacturers of this Type of Boiler. Cable Address, "PAILA," New York. Long Distance Telephone, 1229-18th St., New York.

This Boiler is producing unequaled results in the works of many of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries.

NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES.

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Connecticut Electric Company, at Waterbury, Conn. The building is 51 feet in width by 251 feet in length, with brick walls and iron truss roof covered with corrugated iron. For an Electric Light Station, where the risk from fire is very great, this construction particularly commends itself, as this risk is entirely eliminated.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

Fuel and Its Applications

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Inst., Wash., D. C.

7 PLATES, AND 607 OTHER ILLUSTRATIONS. ROYAL OCTAVO, PAGES XX, 802. HANDSOME CLOTH, $7.50.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

BOOKS.

DISTILLATION OF COAL TAR AN AMMONIACAL LIQUOR.

By GEORGE LUNGE. Price $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.

By DAVID A. GRAHAM. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.

A. M. CALLENDER & CO.,

42 PINE ST., N. Y. CITY

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved.

Price, Cloth, $6.

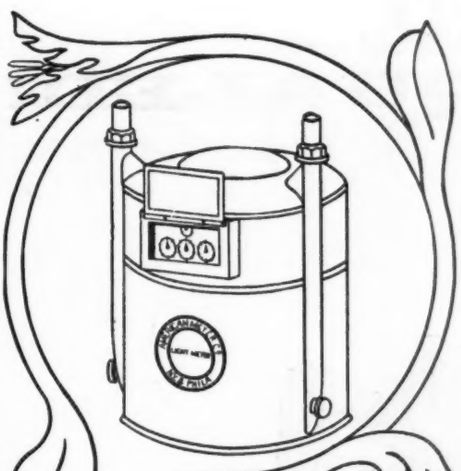
A. M CALLENDER & CO., 32 Pine St., N Y.

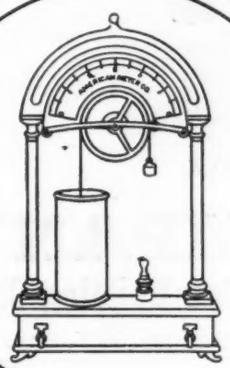
THE CHEMISTRY OF ILLUMINATING GAS.

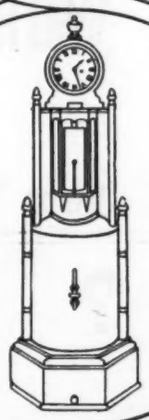
BY NORTON H. HUMPHRYS. Price, $2.40.

Orders may be sent to

A. M. CALLENDER & CO., No. 32 Pine Street, New York City.







AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK and PHILADELPHIA.

CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

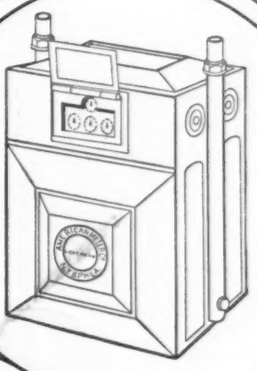
PUBLIC LIGHTING TABLE.

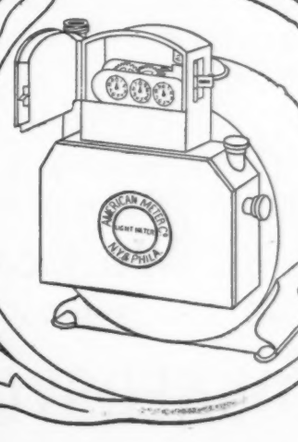
JANUARY, 1894.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Mon.	1	5.20 PM	4.30 AM	4.30	6.30
Tue.	2	5.20	5.30	4.30	6.30
Wed.	3	5.20	6.20	4.30	6.30
Thu.	4	5.20	6.20	4.30	6.30
Fri.	5	5.20	6.20	4.30	6.30
Sat.	6	5.20 NM	6.20	4.30	6.30
Sun.	7	5.20	6.20	4.30	6.30
Mon.	8	5.20	6.20	4.40	6.30
Tue.	9	5.20	6.20	4.40	6.30
Wed.	10	5.20	6.20	4.40	6.30
Thu.	11	8.30	6.20	4.40	6.30
Fri.	12	9.30	6.20	4.40	6.30
Sat.	13	10.30	6.20	4.40	6.30
Sun.	14	11.40 FQ	6.20	4.40	6.30
Mon.	15	1.00 AM	6.20	4.50	6.25
Tue.	16	2.10	6.20	4.50	6.25
Wed.	17	3.30	6.20	4.50	6.25
Thu.	18	4.40	6.20	4.50	6.25
Fri.	19	No L.	No L.	4.50	6.25
Sat.	20	No L.	No L.	4.50	6.25
Sun.	21	No L. FM	No L.	4.50	6.25
Mon.	22	5.40	7.30 PM	5.00	6.25
Tue.	23	5.40	8.50	5.00	6.25
Wed.	24	5.40	10.00	5.00	6.25
Thu.	25	5.40	11.10	5.00	6.25
Fri.	26	5.40	12.10 AM	5.00	6.25
Sat.	27	5.40	1.20	5.00	6.25
Sun.	28	5.40 LQ	2.20	5.00	6.25
Mon.	29	5.50	3.30	5.05	6.15
Tue.	30	5.50	4.30	5.05	6.15
Wed.	31	5.50	5.30	5.05	6.15

TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45

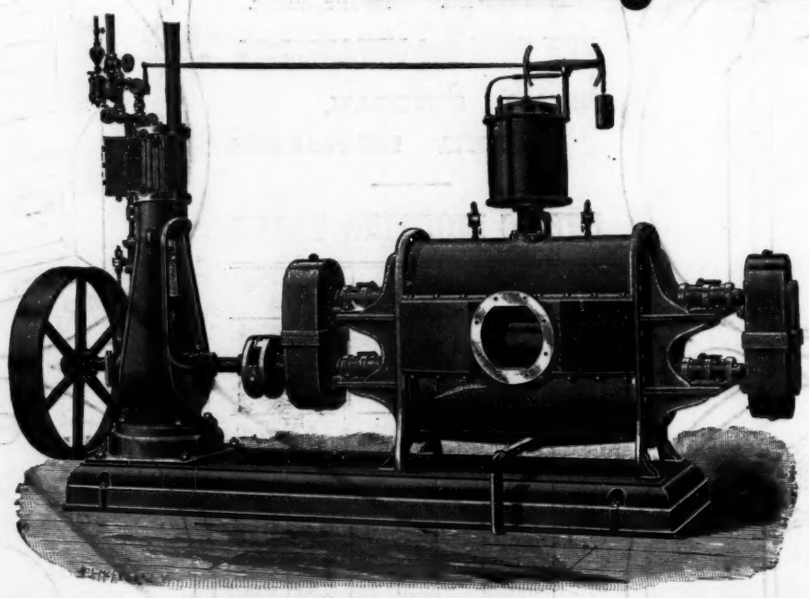




Roots' Gas Exhauster,

Having been in use twenty-five years, it speaks for itself, and stands

UNEQUALED!



P. H. & F. M. ROOTS COMPANY,

Home Office, Connersville, Ind. Branch Office, 501 Manhattan Building Chicago.

S. S. TOWNSEND, Gen. Agt., COOKE & CO., Selling Agts., 163-165 Washington St., N. Y. City.

THE MANAGEMENT OF SMALL GAS WORKS.

By C. J. R. HUMPHREYS.

Price $1.

A. M. CALLENDER & CO., No. 32 Pine Street, New York.

? ? ?

If the

Cycloidal Exhauster

is not

The Best,

Why should competitors make such desperate efforts to **copy** all our new methods of construction? Isn't that indisputable evidence of the superiority of our machines?

We Lead, Others Try to Follow.

When you want a new Exhauster, write for prices to **the** firm prepared to build it on **correct** principles.

The CONNERSVILLE BLOWER CO., Connersville, Ind.

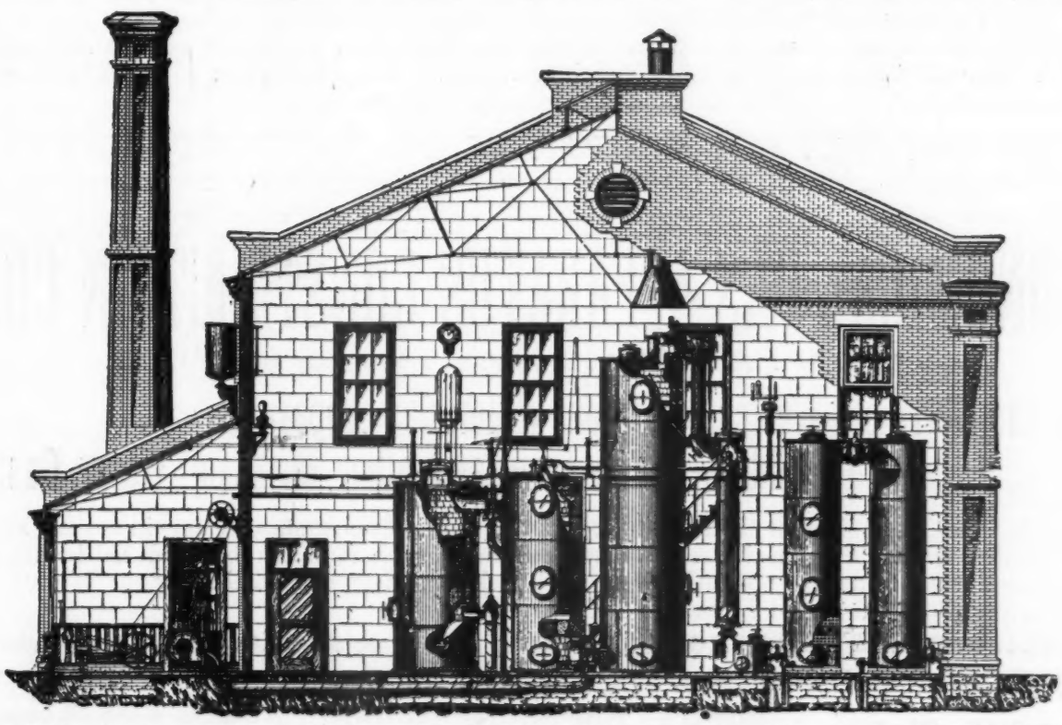
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

BUILDERS, LESSEES AND PURCHASERS OF GAS WORKS.

Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

WATER GAS APPARATUS

BY THE

WESTERN GAS CONSTRUCTION CO.,

Of Fort Wayne, Ind.

The number of Water Gas Plants built by us this year fully testify to the merit of our **Improved** style of **Lowe Water Gas Apparatus.** Results obtained in the various sizes of our plants, up to over 900,000 cubic feet capacity per diem, show what can be attained in a well designed machine. We are prepared to **Guarantee Results,** as well as first-class construction. We build apparatus ranging in capacity from 50,000 cubic feet to 1,000,000 cubic feet per diem, and larger when required.

Our shop facilities are unexcelled, and enable us to quote prices which will prove interesting. The plants in operation demonstrate we have the **Experience** necessary to build Water Gas Apparatus on **Scientific** as well as **Practical** principles, and consequently **Build them Well.** Hence we don't hesitate to **Guarantee the Results.** We not only believe in "Water Gas on its merits," but also in building the apparatus at a price that will not only prove it a desirable investment as to the first cost, but produce results that will put the balance on the right side of your ledger.

There are three essential features in our design which we carefully considered as **Absolute Requirements:**

Durability, neatness, and compactness of the machine.

Minimum labor requirements for operation, and

Minimum amount of material required for results.

And when we add to this a minimum cost of a **Strictly First-Class Apparatus,** can you afford to be without it? If not, write us, and we shall take pleasure in proving our statements to be facts.

Also remember we are not exclusively building Water Gas Apparatus, but if you require **Any Apparatus** for **Coal or Water Gas** and want the latest and best designs, write us for prices, or we will execute carefully your own designs if desired, as we believe in giving you exactly what you want.

THE WESTERN GAS CONSTRUCTION CO., - FORT WAYNE, IND.

W. H. PEARSON, President. J. T. WESTCOTT, Gen'l Mang'r & Treas. (Formerly with The United Gas Improvement Co. L. L. MERRIFIELD, Chief Engineer. (Formerly with the United Gas Improvement Co.)

The ECONOMICAL GAS APPARATUS CONSTRUCTION CO., Ltd.

Office, 269 Front Street, East, Toronto, Ont., Can.

Owners of the Merrifield-Westcott-Pearson Water Gas Apparatus, and Builders of the Lowe and other forms of Water Gas Plants.

Our system includes a combination of the best processes of Water Gas manufacture now in use, and an apparatus of novel construction, which enables us to make a better and cheaper gas than can be produced by any other process. Guarantees given as to quantity of fuel and oil used, make per diem, and candle power. We also make an apparatus which is especially designed for small Gas Companies.

CORRESPONDENCE SOLICITED. Plans and Estimates Furnished upon Application.

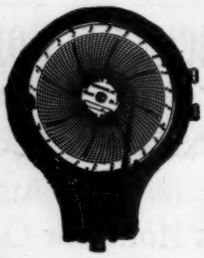
E. G. LOVE, Ph.D.,

Analytical and Consulting Chemist.

Analyses of Coals, Purifying Materials, Gas, Gas Liquor, Water, and all Technical Products. Photometric and Calorimetric Determinations.

122 Bowery, New York City.

BRISTOL'S RECORDING PRESSURE GAUGE



For Continuous Records of

Street Gas Pressure.

Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

Send for Circulars.

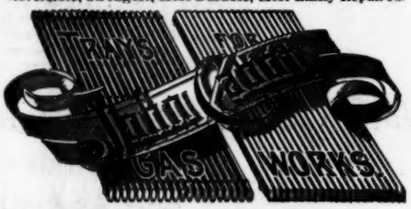
The BRISTOLS' MFG. CO.
Waterbury, Conn.

Received Medal at World's Columbian Exposition.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.



506-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.

Send for Circulars

NATIONAL GAS AND WATER CO.,

218 La Salle St., Chicago, Ill.

HENRY C. REW, Prest. C. D. HAUK, Vice-Prest. & Mang'r. N. A. McCLARY, Sec'y. IRWIN REW, Treas. E. E. MORRELL, Engineer.

Builders and Operators of Gas Works.

WATER GAS APPARATUS A SPECIALTY.

SOLE OWNERS OF THE REW SOFT COAL CARBURETED WATER GAS APPARATUS.

Guaranteed Estimates of Cost of Gas in Holder Furnished upon Application.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION; REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 365 Canal St., New York.

WILBRAHAM BAKER BLOWER COMPANY,

Successors to WILBRAHAM BROS.,

Philadelphia, Pa.,

SOLE MAKERS OF

THE HUNTOON GAS GOVERNOR,

The Best Governor in the Market for Rotary or Steam Jet Exhausters.

Wilbraham Gas Exhausters,

BAKER ROTARY PRESSURE BLOWERS,

And Rotary Piston Pumps.

Catalogues and Prices on Application.

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

JOHN SCHRIEVER, Manager.

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) **Ann Arbor, Mich.**

GAS COALS. CANNEL COALS. COKE CRUSHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

This Colliery is located at Scott Haven, Pa., in the center of the Youghiogheny Gas Coal District, and produces the only reliable Youghiogheny Coal for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

Shipment from LOCUST POINT, BALTIMORE.

ALSO, SOLE SHIPPERS OF THE

Old Kentucky Shale, From Kentucky.

TRADE **O. K. SHALE.** MARK.

THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.

S. CALVERT FORD, Government Inspector at Washington, pronounces this Shale

"ONE OF THE BEST GAS ENRICHERS THAT HAS BEEN OFFERED TO THE TRADE."

He reports it as giving:

12,553 Cubic Feet of 50-Candle Gas,
or 10,460 Cubic Feet of 60-Candle Gas,

AN EQUIVALENT OF 627,650 CANDLE FEET,

And 808 Pounds of Merchantable Coke.

Single Carloads or more delivered at any required point in the United States or Canada.

Cargo Shipments from NEW YORK, PHILA., BALTIMORE and NEWPORT NEWS.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

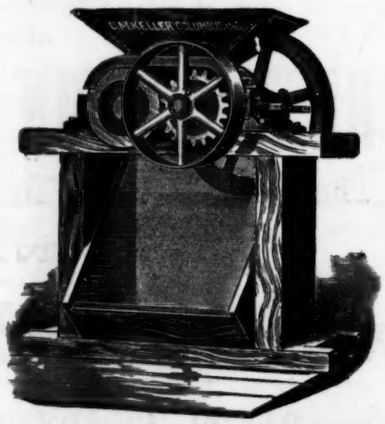
Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for United States 52 William Street, N. Y. City.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. **Columbus, Ind**

Correspondence Solicited.

GAS ENRICHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 44 South Street, Baltimore, M[illegible]

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. { BANGS & HORTON, 60 Congress St., Boston

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

H. C. SLANEY,

Gas Engineer

466 Sixth Street, Brooklyn, N. Y.

Plans, Specifications and Estimates furnished for New Works, Alteration or Extension of Old Plants.

GEORGE R. ROWLAND,

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

JAMES R. SMEDBERG,

Gas Engineer and Architect,

Room 638, Rialto Building,

CHICAGO, ILL.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENACA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

The Management of Small Gas Works.

By C. J. R. HUMPHREYS

Price, $1.00.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited

26 Broadway, New York City.

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
J. H. GAUTIER, Prest. CHAS. E. GAUTIER, Sec. & Treas.
CHA. E. GREGORY, V.-Prest. DAVID R. DALY Gen'l Mang'r.

Brooklyn Fire Brick Works,
MANUFACTURERS OF
CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y

CYRUS BORGNER, Successor to
BORGNER & O'BRIEN
R&B ST. ABOVE RACE PHILADA. PA. U.S.A.
FIRE BRICK AND CLAY RETORTS

Works,
LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Conestoga Bldg., Wood & Water Sts.
PITTSBURGH, PA. P. O. Box 37[illegible].
Successor to WILLIAM GARDNER & SON.
Fire Clay Goods for Gas Works.
SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,
(ESTABLISHED 1856.)
EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS
WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.
Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.
A cement of great value for patching retorts, putting on mouth-pieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.
PRICE LIST.
In Casks, 600 to 800 lbs., f.o.b. N. Y., at 5 cents per pound.
In Kegs, 100 to 300 lbs., " " at 6 " "
In Kegs less than 100 lbs., " " at 7 " "
C. L. GEROULD & CO.,
5 & 7 Skillman St., Brooklyn, N. Y.
Western Agent, H. T. GEROULD, Decatur, Ills.

Parker-Russell Mining and Mfg. Co.,
CITY OFFICE,
Mermod-Jaccard Bldg., Rooms 307 & 308,
Broadway & Locust St., St. Louis, Mo.
PROPRIETORS OF THE
OAKHILL GAS RETORT & FIRE BRICK W'KS
Our immense establishment is now employed almost entirely in the manufacture of
Materials for Gas Companies
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated
Kloenne-Bredel Full Depth and Semi-Recuperator Benches,
And also furnish and build
Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT BALTIMORE MD.
Clay Retorts, Blocks & Tiles
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS
Sole Agents the New England States.

King's Treatise on Coal Gas. In Three Volumes. Price per Vol., $10. Sold either by Volume or in Sets.
Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine and of Gas Cooking and Heating Appliances.
A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

FRED. BREDEL, C. E.,

PROP'R OF KLOENNE AND BREDEL PATENTS.

Recuperative Furnaces, Purifying Machines,

Gas Apparatus.

Main Office, 118 Farwell Avenue, Milwaukee, Wis.

New York Office, 22 Beaver Street.

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.

A Large Quantity of Ground Fire Brick For Sale Cheap.

1893 DIRECTORY 1893

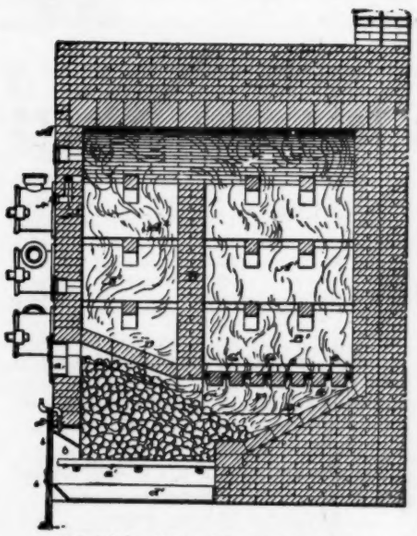
OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL.

$3.00 per Annum.

A. M. CALLENDER & CO.
32 Pine Street, N. Y

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY

Gas Companies and others intending to erect Lamp and Posts will do well to communicate with us.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sa unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., No. 54 Pine St., N. Y.

DAVIS & FARNUM MFG. CO.

WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, WALTHAM, MASS. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

Single, Double and Triple-Lift

GASHOLDERS

of any Capacity.

Tubular, Pipe and Sinuous Friction

CONDENSERS

of all Sizes.

STEEL TANKS for GASHOLDERS. IRON ROOF FRAMES and FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

— ALSO —

GAS AND WATER PIPE, FLANGED PIPE,

Sugar House Work, and Special Castings of all Description.

This space belongs to the

KERR MURRAY MANUFACTURING COMPANY

All communications addressed to them at

Fort Wayne, Ind.

will receive prompt attention.

BARTLETT, HAYWARD & CO.

Baltimore. Md.

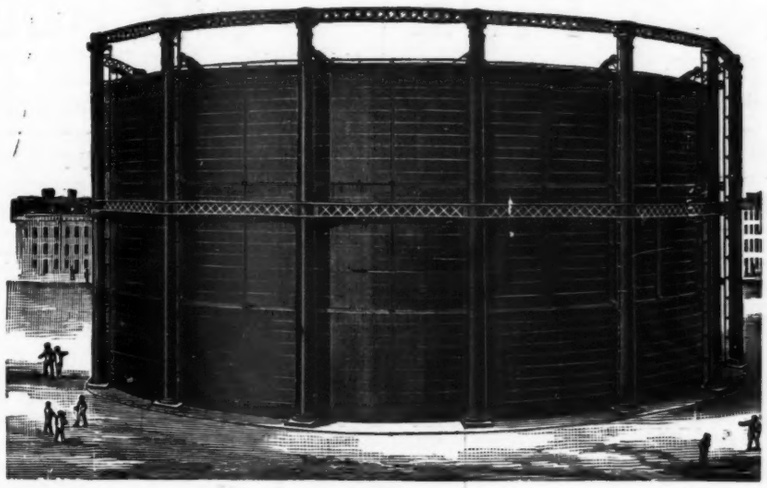
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

SCIENTIFIC BOOKS.

ING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S GUIDE. $1.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

CHEMISTRY OF ILLUMINATING GAS, by NORTON H. HUMPHRYS. $2.40.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

PRACTICAL PHOTOMETRY: A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT. By W. J. DIBDIN. $3.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

HEAT A MODE OF MOTION, by JOHN TYNDALL. $2.50.

MUNICIPAL LIGHTING, by F. H. WHIPPLE. $1.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

THEORY OF HEAT, by J. CLERK-MAXWELL. $1.25.

AMMONIA AND AMMONIUM COMPOUNDS, by DR. R. ARNOLD. $2.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTLLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS COMPANIES DIRECTORY, 1893. $5.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY, by Professor VICTOR VON RICHTER. $2.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

HANDBOOK FOR MECHANICAL ENGINEERS, by HENRY ADAMS. $2.50.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS, by THOS. NEWBIGGING. Fifth edition. $6.

A TREATISE ON MASONRY CONSTRUCTION. BARKER. $5

FUEL AND ITS APPLICATIONS. $7.50.

ELECTRICITY.

THE ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage, and Distribution, by PHILIP ATKINSON. $1.50.

ELEMENTARY ELECTRICITY, by PROF. F. JENKIN. 40 cts

ELECTRIC TRANSMISSION OF ENERGY, by G. KNAPP. $3

ARC AND GLOW LAMPS, by J. MAIER. Illustrated. $3.

ELECTRICIAN'S POCKET-BOOK, by MONROE and JAMIESON $2.50.

MAGNETISM AND ELECTRICITY, by J. OVEREND. 40 cents

ACCUMULATORS, by SIR D. SALOMONS. $1.20.

DYNAMO BUILDING, by F. W. WALKER. 80 cents.

ELECTRICAL TABLES AND FORMULÆ, by L. CLARK R. SABINE. $5.

ELECTRIC LIGHTING FROM CENTRAL STATIONS, by G FORBES. Paper. 40 cents.

ELECTRIC LIGHT PRECAUTIONS, by K. HEDGES. Illustrated. $1.

DOMESTIC ELECTRICITY FOR AMATEURS, by E. HOSPITALIER. $3.

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., 32 Pine Street, New York

Foundries and Works: { Millville, N. J. / Florence, " / Camden, "

R. D. WOOD & CO.

ENGINEERS, IRON FOUNDERS, MACHINISTS

400 Chestnut Street, PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE

SOLE MAKERS OF

THE MITCHELL SCRUBBER

(PATENTED)

PURIFIERS, CONDENSERS, SCRUBBERS.

THE HOPPER AUTOMATIC GAS GOVERNOR.
BENCH WORK. PLATE GIRDERS.
IRON FLOORS AND ROOFS.

BUILDERS OF

GAS HOLDERS

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

PEASE'S PATENT WIRE ROPE GUIDING FOR GAS HOLDERS.

CUTLER'S
PATENT FREEZING PREVENTER
FOR GAS HOLDER CUPS.

THE TAYLOR REVOLVING BOTTOM GAS PRODUCER,
HEAVY LOAM CASTINGS, DUNHAM SPECIALS, HYDRAULIC WORK
LAMP POSTS, VALVES, ETC.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

in the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

ISBELL-PORTER COMPANY,

G. G. PORTER, Prest. (Successors to SMITH & SAYRE MFG. COMPANY) CHAS. W. ISBELL, Secy.

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

Special Castings, Tees, Bends, etc.
Bench Castings.
Water Gas Generators.
Hydraulic Mains.
Iron Floors.
Brenner Self-Sealing Retort Lids.
Tar Gates and Hydraulic Main Dip Regulators.
Hutchison's Tar Displacement Apparatus.
Multitubular Condensers.
Standard Washer-Scrubbers.
Tower Scrubbers.
Walker's Tar and Carbonic Acid Extractors.
Exhausters.
Engines.
Steam Jet Exhausters.
Exhauster Governors.
Compensators.
Self-Acting Bye-Pass Valves.
Valves.
Valve Stands with Indicators.
Purifying Boxes.
Purifier Valve System.
Center Seals.
Street Governors.

Estimates, Drawings and Specifications Furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

ISBELL-PORTER COMPANY,

No. 245 Broadway, New York City.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,

(SUCCESSORS TO HERRING & FLOYD)

Oregon Iron Works,

W. 20th & 21st Sts., bet. 10th & 11th Aves.

NEW YORK CITY.

ENGINEERS AND CONTRACTORS FOR THE

Construction of Gas Works.

MANUFACTURERS OF

All Kinds of Castings and General Ironwork

FOR

GAS APPARATUS.

BENCH CASTINGS, REGENERATIVE AND HALF REGENERATIVE FURNACE CASTINGS.
CONDENSERS.
TOWER SCRUBBERS.
MECHANICAL SCRUBBERS.
PURIFIERS.
MALLEABLE IRON RETORT LIDS.
SELF-SEALING RETORT LIDS.
HYDRAULIC HOIST PURIFIER CARRIAGE.
CROSSES, TEES, BENDS, ANGLES, REDUCERS, S-BENDS, SECTIONAL SLEEVES, PLUGS, CAPS, STREET DRIPS, ETC., ALWAYS ON HAND.

Seller's Cement.

WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS,

In use at Syracuse, N. Y.; Elizabeth, N. J.; Boston, Mass.; Watertown, N. Y.; Cortland, N. Y.; Jamaica Plain, Mass.; Northern Liberties Gas Co., Phila.

SOLE MANUFACTURERS OF THE

OGDEN QUICK-MOVING VALVE.

Plans, Specifications and Estimates furnished for Construction of New or Alteration of Old Works.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

Foundry: 33, 35, 37 & 39 Mill Street. **Wrought Iron Works:** 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

1842. **DEILY & FOWLER,** 1894

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

GASHOLDERS,

Single and Telescopic.

Holders Built 1886 to 1892, Inclusive

Galveston, Texas. (3d.)	Malden, Mass.	Lancaster, Pa. (3d	Oakland, Cal.	So. Bethlehem, Pa. (2d)
Fort Plain, N. Y.	Paducah, Ky.	Tacony, Pa. (two)	Central Gas Lt. Co., New	"Vassar College," N. Y
Brunswick, Ga.	Norwich, Conn.	Mount Vernon, N. Y.	York City (2d)	So. Chester, Pa.
Port Chester, N. Y.	Seattle, W. T.	Binghamton, N. Y.	Tacoma, Wash.	Cumberland, Md.
New Rochelle, N. Y.	San Diego, Cal.	Concord, N. H.	Knoxville, Tenn.	Auburn, N. Y.
Salem, N. J. (3d)	Westerly, R. I.	Dover, Del. (2d)	Pottstown, Pa.	DesMoines, Ia.
Omaha, Neb. (2d)	Northern Gas Lt. Co., of	Calais, Me.	Victoria, B. C.	Brooklyn, N. Y.
Lynn, Mass. (3d)	New York, N. Y.	New London, Conn. (2d)	Vancouver, B. C.	Washington, D. C. (2d
Little Rock, Ark.	Willimantic, Conn	West Chester, N. Y.	Charlottesville, Va.	Wilkes-Barre, Pa.
Irvington, N. Y.	Montclair, N. J.	Bay Shore, L. I.	So. Framingham, Mass.	Bridgeport, Conn. (2d)
South Boston, Mass.	Attleboro, Mass.	Washington, D. C.	Woonsocket, R. I.	Sing Sing, N. Y.
Rye, N. Y. (2)	Santa Cruz, Cal.	Newport, R. I. (2d)	Simcoe, Can.	Exeter, N. H.
Staten Island, N. Y. (3d)	Erie, Pa. (2d)	Morristown, N. J.	Pittsfield, Mass. (2d)	Wilkes-Barre, Pa., ons
Woodstock, Ont.	West Chester, Pa. (2d	Lebanon, Pa.	Chattanooga, Tenn. (2d)	Lynn, Mass. (2d) [Gas Co

ILLUMINATING GAS! FUEL GAS!

The Loomis Process.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Sons' Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

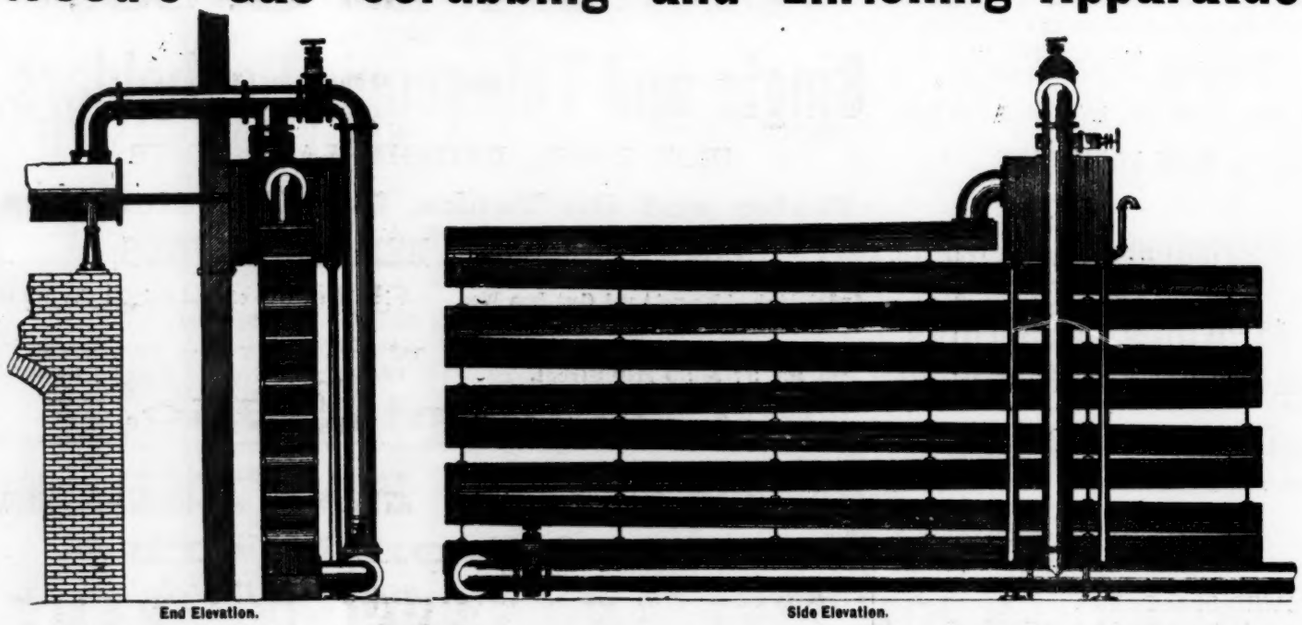
ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.

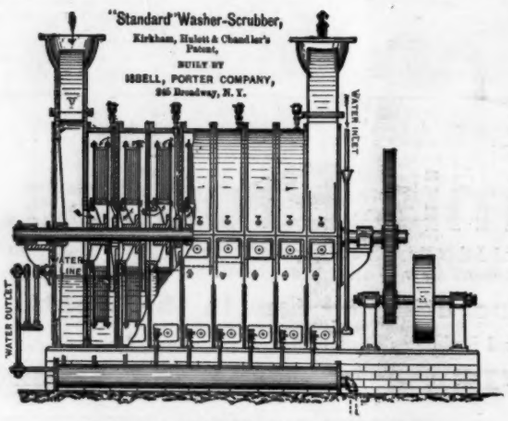
Wood's Gas Scrubbing and Enriching Apparatus.



End Elevation. Side Elevation.

The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

JAMES R. FLOYD & SONS, - - Nos. 531 to 543 West 20th Street, N. Y. City.



Estimates Furnished on Application.

"STANDARD" WASHER-SCRUBBER

The only apparatus that will remove ALL the ammonia and one-third of the Carbonic Acid and Sulphureted Hydrogen from Coal Gas.

86

of these machines, capable of dealing with 75,082,000 cubic feet of gas daily, have been erected in the United States, and 456 in Great Britain. The "Standard" will save 25 per cent. to 35 per cent. on the investment through the sale of ammonia.

GEORGE SHEPARD PAGE'S SONS,

No. 68 Wall Street, - - - New York City.

FIELD'S ANALYSIS

For the Year 1892.

An Analysis of the Accounts of the Principal Gas Undertakings in England, Scotland, and Ireland. Being the Twenty-third Year of Publication. Compiled and Arranged by

JOHN W. FIELD, Accountant to the Gas Lt. and Coke Co., London.

Price, $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City

GAS AND WATER PIPES.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

GREENOUGH'S "DIGEST OF GAS LAW."

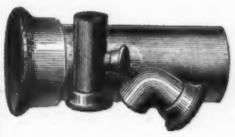
Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

GAS METERS.

WARREN FOUNDRY AND MACHINE CO.



Established 1856. Works at Phillipsburgh, N. J.

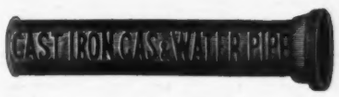
New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc

M. J. DRUMMOND,



SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

THE ADDYSTON PIPE AND STEEL COMPANY,

CAST IRON.

PIPE.

CINCINNATI, OHIO.

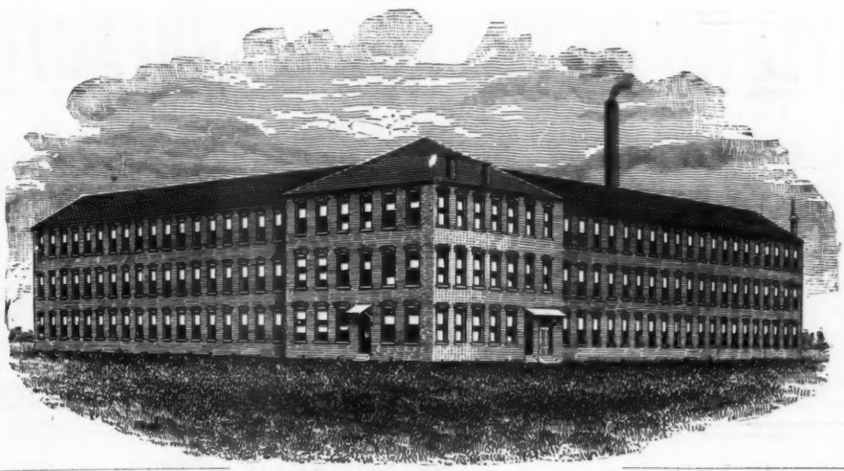
Purifiers, Condensers, Scrubbers & Center Valves

SPECIALS, FLANGE PIPE, AND LAMP POSTS.

C. N. PAYNE, Prest.

J. B. WALLACE, Supt.

F. H. PAYNE, Sec. and Treas.



Factor and Office

ERIE, PA.

ESTIMATES FURNISHED ON APPLICATION.

Agency,
McELWAINE-RICHARDS CO.,
62 & 64 W. Maryland St., Indianapolis, Ind.

METRIC METAL CO.,

MANUFACTURERS OF

Dry Gas Meters

FOR ALL KINDS OF SERVICE.

Special Attention Paid to REPAIRING METERS OF ALL MAKES.

G. M. WITHERDEN, Agent.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
No. 52 Dey Street, NEW YORK. No. 75 North Clinton Street, CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Established 1849.

With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

153 Franklin St., Boston, Mass.

C. W. HINMAN, - - Manager.

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Phila., Pa.

Agency, 67 & 69 S. Canal Street, Chicago.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

WM. N. MILSTED, Prest. and Genl. Supt. WM. H. HOPPER, Vice-Prest. PAUL S. MERRIFIELD, Sec. and Treas.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y
Arch & 22d Sts, Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
380 Main Street, Cincinnati.
125 & 127 S. Clinton Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

D. McDONALD & CO.,

Established 1854.

154 West 27th Street, NEW YORK CITY.
51, 53 & 55 Lancaster St., ALBANY, N. Y.
34 & 36 W. Monroe St., CHICAGO, ILL.

MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

A CONVENIENT

BINDER for the JOURNAL.

STRONG.
DURABLE.
LIGHT.
SIMPLE
CHEAP.
HANDSOME.
Price, $1.

A.M. Callender & Co., 32 Pine st., N.Y. City

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

350 Pages, Full Gilt Morocco. Price, $3.00.

A M. CALLENDER & CO., 32 Pine St., N. Y

UNEQUALED

For efficiency and low gas consumption.
For smooth and quiet running.
For simplicity of construction and grace in design.
For general reliability.
For close regulation of power.

150 MEDALS AND DIPLOMAS.

The "OTTO"--The First.

The First to use the four-stroke cycle. **The First** to admit well measured and distinct charges of gas into an air space. **The First** in the adoption of poppet valves. **The First** to develop the tube igniter, with automatic or timed firing. **The First** to have a reliable electric and a practical magnectic igniter.

THE FIRST SMOOTH RUNNING & NOISELESS GAS ENGINE COMBINING EFFICIENCY & SIMPLICITY.

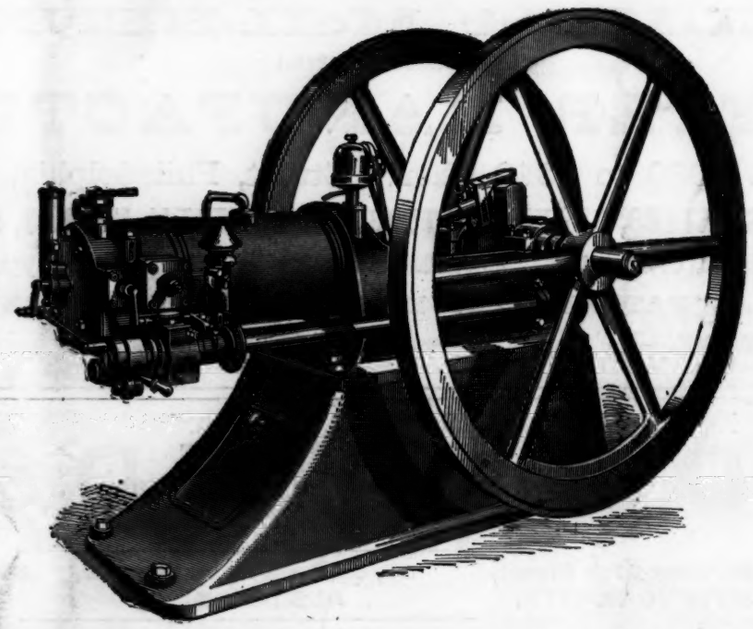
Our Columbian Style

IS FITTED

With removable seats and casings for all valves.

With Patent Alloy Tube, good for one year.

With timing device for ignition, preventing starting backward; or with electric igniter.



SIMPLICITY, as far as is possible, with good design and perfect Working. Built on scientific principles, with a view to **HIGHEST EFFICIENCY**

Sizes,
1-3d to 120 H.P.

The First to have change speed governors; to have separate and removable casings for all valves; to adopt automatic oiler rings on main journals; to provide for Patent Alloy Tube, dispensing with frequent renewals of iron or nickel tubes to use spiral gearing and dispense with noisy running.

The First and Only Engine To-day to Please Every Purchaser.

DEMONSTRATION

It is almost a quarter of a century since the "Otto" revolutionized old and bad practices by introducing principles of combustion "entirely new" in the construction of Gas Motors.

A quarter of a century of uninterrupted success has demonstrated the correctness of these principles.

The gas engine history of the past proves that all competitors have recognized this fact by becoming imitators.

Since its advent the "Otto" engine has been illustrating mechanical improvement without alteration, while others have been offering alterations as improvements.

The experience of the past shows that it requires years to determine the real merits of a gas engine, and that nearly all new gas engines prove failures. **The fittest survive, and the only safe thing to do** in selecting a gas engine is to buy what the tests of practical use, through a long period of time, have proven to be the best.

The Practical Tests of a Quarter of a Century have Demonstrated that the "OTTO" Stands To-day Unrivaled

For simplicity of construction and grace in design; for general reliability and ease of management; for quiet and smooth running qualities; for efficiency and low gas consumption; for regularity of speed and close regulation of power.

"OTTO GAS ENGINE WORKS," 33d & Walnut Streets, Phila., Pa.

NEW YORK, 18 Vesey St. BOSTON, 19 Pearl St. CHICAGO, 245 Lake St.